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**SCHOOL OF CIVIL AND ENVIRONMENTAL
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MSc Thesis

On

**WORK PROGRAMMING AND IMPLEMENTATION PRACTICE IN ETHIOPIAN
FEDERAL ROAD PROJECTS**

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DECLARATION

I declare that this thesis entitled “WORK PROGRAMMING AND IMPLEMENTATION PRACTICE IN ETHIOPIAN FEDERAL ROAD PROJECTS” is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

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ABSTRACTS

In Ethiopia, road constructions have been undertaken under the Road Sector Development Programme (RSDP) established in 1997. In the last 17 years, the programme implemented in four stages accomplished with encouraging success. However, there remain a number of challenges experienced in the programme including problems observed at monitoring of progress and delay analysis.

In relation, this research aims to study work programming and implementation practice in Federal road projects. Accordingly, a comprehensive literature survey was made to highlight the overview of work programming and implementation practice.

The methodology adopted comprises questionnaires survey and case studies. Accordingly, questionnaires were distributed to the three key groups of participants in road construction project; namely the employer, consultants and contractors. IN addition, case study was also undertaken on seven projects.

The research revealed that contractors consider various factors during the preparation and implementation of work program, however, limitations in considering the following factors is observed, choice of work programming method, right of way requirement description, design of project logic, external environment factors, project calendar establishment, and climatic conditions in the programming stages are not being submitted. In addition, the research has also shown that contractors fail to submit as per the time specified in the contract and get approval from the consultant. As to implementation practice, the research also shown that the programs being submitted will not assist in project monitoring and delay analysis. Whereas, the research also revealed that the programs being implemented are practical and implementable. The study also revealed that work programs submitted do not assist parties to track deliverables and milestones. Finally, the research has also pointed out the mitigation and intervention measures to be taken by parties. The inadequacy of work programming and implementation practice might attribute for the familiar delays and cost overruns in the Federal road construction project of Ethiopia.

Thus, it is very important that all parties involved in road projects improve their planning and programming practices. The Employer shall also play his role for creating positive awareness towards contract management.

Keywords: *Planning, Scheduling, Programming, Milestones, Delay Analysis, Project Logic.*

ABBREVIATIONS AND NOTE

- ☞ BOQ - Bill of Quantity
- ☞ CoPA - Conditions of Particular Application
- ☞ CPM - Critical Path Method
- ☞ DRE - Dispute Review Expert
- ☞ ERA - Ethiopian Road Authority
- ☞ EOT – Extension of Time
- ☞ FIDIC - Fédération International des Ingénieurs Conseils
- ☞ FDRE - Federal Democratic Republic of Ethiopia
- ☞ GCC - General Conditions Contract
- ☞ OBS - Organizational Breakdown Structure
- ☞ PMI - Project Management Institute
- ☞ PPA - Public Procurement Agency
- ☞ ROW - Right of Way
- ☞ RSDP - Road Sector Development Program
- ☞ WBS - Work Breakdown Structure

CHAPTER ONE: INTRODUCTION

1.1. General

Under Road Sector Development Programmes (RSDP), the Government of the Federal Democratic Republic of Ethiopia (FDRE) has awarded many road projects to domestic and international contractors. From the beginning of the RSDP programme, different domestic and international contractors as well as professionals of the stream have participated in the road construction industry. The Government of Ethiopia formulated the RSDP in 1997 and till the end of 2014, the programme intends to construct 128,466km and it accomplishment until such period reported as 110,466km. From the allocated budget, local contractors' participation was 42%, involving in 278 projects. [ERA, 2014]

Over the past 17 years, 41.2% of the total RSDP expenditure was on rehabilitation and upgrading roads, 28.8% was on construction of link roads, 5.7% on maintenance of federal roads, 8% on regional road and 11.7% on Woreda roads and 2.8% was on institutional support projects and the remaining portion other activities at the federal level [ERA, 2014].

The foregoing program developed by the government is made with the view taking the initiative towards making Ethiopia a developed country. Nevertheless, in ensuring these successive programs to be completed and utilized, some important elements must be considered, such as cost, time period and design quality. Thus, in this research, time factor for the completion of a project is considered and studied.

Road construction projects have adopted work programming practice using manual or computer software operations. The client, the consultant and the contractor has been using work programs for the purpose that assists the objectives of their institution.

Generally, however, the preparation and implementation of the work programs has become critical factor that involve the participation of the parties involved in the contract coupled with other parties in the implementation of the project.

Therefore, this research is done to examine the work programming practice, the challenges in the submission and approval process and the use of work programs in the implementation of the project.

1.2. Background of the Research

Construction work programming has come a long way in years counted backward. Unfortunately, despite the widespread use of computerized work programming on construction projects today, there still exists a large disparity in the level of understanding in the proper use of this powerful tool. Some even say there is a crisis in the construction industry because they believe scheduling software is being misused to assert delay claims and there is, in their view, a predominance of poor quality schedules.

The monitoring and control for construction projects sometimes cannot be seen on the whole and it takes a long time to reach a solution for any problem. The planning which is drafted together with current needs at that time will also give rise to late possession of sites and other problems regarding to site possession. In association with that, the clients and contractors should be exposed to the importance and benefits of using work programming as an effective way to plan future work.

Different scholars have identified various factors as the causes of delay and cost overrun of construction projects. Among these factors, some are individual project specific and others are related to the nature of the construction industry at large. Among the factors, project management associated factors, specifically project planning related factors, are commonly placed at the top in the ranking of factors.

According to Twomey [2006], delivering a project on time relies on managing the development process, choosing experienced professionals, assessing timeframes realistically, and anticipating that some unforeseen problems are likely to come up. Aggressive management of typical work programming issues that occur throughout construction can help ensure that projects are completed within the intended timeframe.

Behailu [2006] as well found factors attributed to the delay and cost overrun of road construction projects in Ethiopia, some of these are explicitly related to planning and scheduling of projects. These include the following:

- Planning and management problem.
- Inadequate resource on site (plant and equipment); and
- Lack of professional staff on site;

Aberra [2005] on his study on the Alternative Dispute Resolution method of the Ethiopian Construction Industry identified a range of causes for delay in construction projects of Ethiopia. The following are among these factors related to project planning and scheduling.

- Problems in contractors to supply the required materials, equipment and manpower as scheduled;
- Misuse of Advance Payments outside the corresponding projects;
- Employers have not planned projects carefully;
- Right of Way Problems.

Bong [2009] in his research “Factor Affecting the Preparation of Construction Work Schedule” cited that complexity of the project, identification of critical activities and type of the project is the three top factors that affect the preparation of work programs.

Researchers, who conducted such investigations, commonly recommended proper project planning and scheduling to be established to enhance project performances minimizing, if possible avoiding, delay and cost overrun.

During preparation of this thesis, the above and other previous theses are reviewed and it is noted that work programming is addressed in the broader aspect of planning and scheduling. This thesis aims to focus only on work programming required to be submitted by the contract requirements under FIDIC 1987 reprinted in 1992 and Public Procurement Agency (PPA) conditions of contract and its implementation practice in road projects.

Thus, in this research, it is planned to examine the work programming and implementation practice in federal road projects and will address the question related to the preparation of work programs, challenges in submission and approval of work programs, monitoring, practicality, deliverables tracking, and review of remedial rights. The study also highlights the improvement and intervention actions required to be taken by the owner (ERA), contractors, and consultants role to improve the preparation and implementation of programs.

1.3. Statement of the Problem

In road construction projects it is easy to see that some project participants care more about their schedules than others. Some contractors prepare work program only because it is a contract requirement. On far too many projects work program is created at the beginning of the project and never reviewed or revised until a problem develops. The best approach is for all project participants to join in the scheduling process and develop a meaningful schedule, and then use it throughout the duration of the project. This is most likely to happen when the schedule is realistic, useable, and understood by all of the project participants.

Besides, Singh [2004] mentioned that work program submitted by the contractor should contain the main activities, sequence of activities, timing of activities, critical activities and critical path, and important milestones. Since there are no clear guidelines for the application of project programming in project management the current practice is entirely depending on the experience of the project manager or any other professional assigned for the preparation of the program. This has resulted in a lot of time wasting effort before parties involved in the project accept any work schedule. In addition, there are still weaknesses in terms of formal guidelines for the preparation and submission of work schedule.

Ethiopian federal road construction projects are facing difficulty with regard to having a proper, realistic and purposeful work programs. In addition, difficulty is also experienced in relation to the submitted work programs, as the programs at hand;

- Might not be constructible/practical,
- Might not assist as project monitoring tool, review of remedial rights, tracking of deliverables, etc.

- It is common to hear that contractors do not submit and get approved work programs as per the requirement of the contract provisions due to several factors.

Thus, this study will attempt to answer the following key questions;

- How do contractors involved in federal road construction projects prepare work programs?
- Why do contractors fail to submit and get approval projects' work programs on time?
- Are the work programs submitted by contractors are usable for project monitoring, tracking of deliverable and review of remedial rights?
- What improvements and intervention actions are required from contractor's, employer's and consultant's side to prepare more realistic work program?

1.4. Objectives of the Research

The general objective of this research project is to assess the work programming and implementation practice and to integrate conceptual material with the practical experience in federal road construction projects.

The specific objectives of the research project are:

- ☞ To examine the existing work program preparation practice.
- ☞ To assess the challenges in submission and approval process.
- ☞ To assess the use of work program in relation to;
 - Implementation/Constructability of work programs
 - Monitoring of progress
 - Tracking of deliverables
 - Review of remedial right
- ☞ To recommend improvement and intervention actions in work program preparation and implementation.

1.5. Significance of the Research

The outputs of the research will show the status of work program preparation and implementation practice in Ethiopian federal road construction projects. Hence, the research will benefit different stakeholders and to the industry in such a way that;

1. To Contractors

The study will help contractors to produce good and realistic work program for the project and lastly it will help the project to be completed on time successfully by using it during progress monitoring and evaluation for internal purpose.

2. To Consultants and Employers

Consultants and clients will get a review of the work program preparation process as well as ideas related to factors to be considered during the review of work program, work program submission and approval, progress monitoring, deliverables tracking and review of remedial rights.

Finally, the parties will also be benefited from the recommendations and improvement actions that will be made and suggested based on the actual data obtained from the industry through questionnaire survey and case study.

1.6. Research Methodology

The study was carried out using a three phase approach.

- The first is to review the relevant literature on the subject work programming, in particular based on FIDIC 1987/1992 and PPA 2006 conditions of contract.
- In the second phase, a pilot study which took the form of structured questionnaire was conducted with selected contractors, client and consultant professionals coupled with case study analysis for selected projects, in the Ethiopian road construction industry.
- In the third phase, conclusions and recommendations are drawn from the outcome of the analysis.

1.7. Scope and Limitations of the Study

All professionals selected for the collection of data were personnel that are involved in road projects implemented in Ethiopia.

The scope of the research is confined to contractors registered as grade one and involved in federal road projects, consultants registered as class three and above involved in road project and clients represented by the five regional project administration under implementation by Ethiopian Roads Authority.

Whereas, the limitation of the research are the following but not limited to;

- Shortage of literatures and previous studies
- Non responsiveness of professionals, that questionnaire is distributed.

1.8. Thesis Organization

The research is organized into five chapters which are summarized as follows;

- i) Chapter One: introduces the research problem and the aim of the study followed by the objectives of the research in achieving the depicted aim.
- ii) Chapter two: is a literature review from professional journals, books, internet searches and discussions with professionals with road contract administration experts.
- iii) Chapter three: discusses the research methodology followed in order to achieve the objectives of the study.
- iv) Chapter Four: the results of the data obtained from the questionnaire survey and case study projects were presented and discussed accordingly.
- v) Chapter Five: conclusions and recommendations were forwarded based on the major findings of the study and discussed how the research objectives align with the findings.

CHAPTER TWO: LITERATURE REVIEW

2.1. An Overview of Work Program

2.1.1. Definition of Project

Before going into the details project work programs it is imperative to answer the following question. What is a Project?

According to Project Management Institute, PMI [2008] project is defined as a temporary endeavor undertaken to create a unique product, service, or result. Mubarak [2010], provides the interpretation of this definition by spotting out the key works incorporated therein, i.e.

- Temporary: any project must have a starting point and ending point
- Unique: it must have a deliverable product or service.

Then for the execution of the project or to envisage the product anticipated it entails to have project program.

2.1.2. Contract

From the various definitions that attempt to encapsulate the essential nature of a contract; two of them are stated here below:

- Contract is an agreement between two or more parties in which each party binds himself to do or forbear to do some act and each acquires the right to what the other promises [Bunni, 2005].
- Contract as an agreement whereby two or more persons as between themselves create, vary or extinguish obligations of a proprietary nature. [Civil Code, 1960]

2.1.3. Definition of Work Program

No express definition appears in the typical standard conditions of contract. However, the following are mentioned in FIDIC 1987 Standard Conditions of Contract.

- FIDIC [1987 reprinted in 1992] states it is program that will be used for the execution of the works.
- Sawyer and Gillott [1990] state the contractor will submit a program in such a detail and form required by the Engineer¹, for the execution of the works; to provide in writing a

¹ *The Engineer is a party whose name is in the contract and has a duty of administration of the contract between the contractor and the Employer as set out clearly in the contract.*

general description of the arrangement and method proposed for the execution of the works.

The notion of work program has been stated in FIDIC conditions of contracts as one of the responsibility of the contractor to prepare and submit to the engineer for his consent.

Likewise, Public Procurement Agency. PPA [2006] states that the contractor shall submit to the engineer for approval a program showing the general methods, arrangements, order, and timing for all the activities in the works.

Sharma, (2008) on his side states a project work program is the project's time schedule, i.e. a time table of work.

On the other hand, the concept of work programming is also expressed in terms of or as a part construction planning, programming and scheduling of projects. The definitions and interpretations read in different literatures vary from one another, however, the followings are chosen for the purpose of this research paper.

2.1.3.1. Planning

Project planning is defined in many ways, Table 1 shows a variety of definitions to give a more complete picture of what planning is.

Table 1: [Definitions of planning]

Reference	Definition of Planning
Harold Kerzner, 2009	The function of selecting the enterprise objectives and establishing the policies, procedures, and programs necessary for achieving them.
Mubarak, 2010	The process of choosing one method and order of work to be adopted for a project from all the various ways and sequences in which it could be done.
Sharma, 2008	Projects are planned for creating physical facilities within time and cost to meet predetermined needs and objectives.

2.1.3.2. Scheduling

Project scheduling is defined in many ways, Table 2 shows a variety of definitions to give a more complete picture of what scheduling is.

Table 2: [Definitions of Scheduling]

Reference	Definition of Scheduling
Trauner, 2009	A project schedule is a written or graphical representation of the contractor's plan for completing a construction project that emphasizes the elements of time and sequence.
PMI, 2008	A project schedule, in its simplest form, is a table of activities with the associated scheduled dates when activities and milestones are to take place.

2.1.3.3. Programming

Project programming is defined in many ways, Table 3 shows a variety of definitions to give a more complete picture of what programming is.

Table 3: [Definitions of Programming]

Reference	Definition of Programming
Abomina, 2013	The program for the works indicating the logic sequence and duration of all activities to be completed by the contractors, sub contractors and suppliers in appropriate detail, for the monitoring of the progress of works
Cowlin and Dunn, 2009	Program is a schedule or chart showing stages in a scheme of work.

2.1.4. The Enigma of Planning, Scheduling and Programming

In explaining the similarities and differences of the three words different scholars have forwarded their view as stated herein below;

While explaining the differences of planning and scheduling Trauner [2009] among others, mentioned that "project schedule" emphasizes the elements of time and sequence, i.e. illustrate the intended timing of the major work items necessary to demonstrate how and when the contractor will construct the project and whereas the "project plan" will typically identify the major work items (activities) and depict the sequence (logic) in which these work items will be constructed to complete the project. Furthermore, he mentioned that contractors use project schedules to depict and communicate the construction plan among the subcontractors and other project participants. Likewise, Mubarak [2010] in further explaining the difference between planning and scheduling used the below figure to show that scheduling is just one part of the planning effort. Hence, scheduling focuses on one part of the planning effort. Project planning answers the questions What is going to be done? How? Where? By whom? and When? whereas scheduling deals with when on a detailed level.

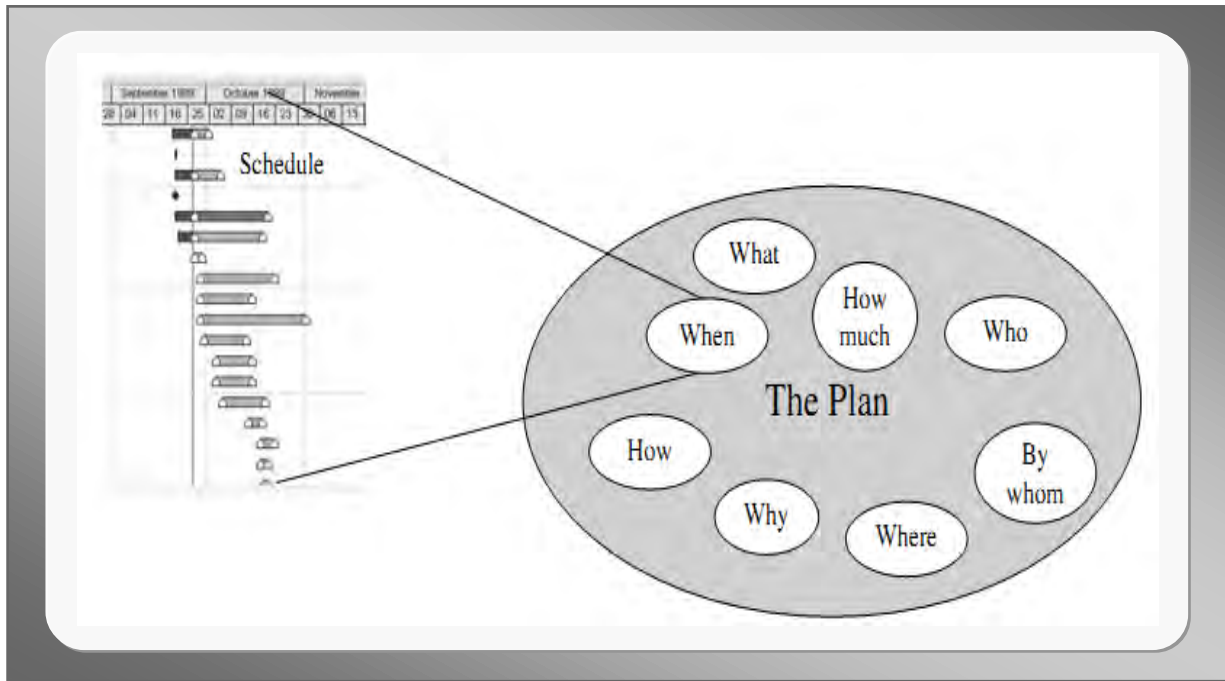


Figure 1: Planning and Scheduling, [Mubarak, 2010]

As to project programming and scheduling, Keane and Caletka [2008], mentioned the similarity of project programming and scheduling stating that both are the process of identify individual tasks, assign resources and budgets to each, create a baseline which determines the earliest and latest allowable start and finish times for each activity, the available float to each activity, and the critical path through the project.

Whereas, FIDIC [1987 reprinted 1992] states the program to include the bar chart, CPM network diagram, method statement and other considerations, which tells that programming is more than the scheduling work.

The above being the differences and similarities of the three enigmas, for the purpose of this research programming is considered to represent the work program referred in FIDIC conditions of contract.

2.1.5. Significance of Work Programming

Work programming has valuable benefit for the implementation and control tool in the construction industry. Murray [2007] in explaining the benefits states, without exaggeration, virtually every aspect of project management evolves around the execution schedule. A popular analogy compares the project manager to the commercial airliner pilot and the project scheduler to

the pilot's navigational officer. If that is so, then the execution schedule itself must be the flight plan. It doesn't get more significant than that.

As such, it is the primary document in the project record that can provide a detailed picture of the project's planned construction sequence. If a project program is properly developed and updated throughout the duration of the project, then it will provide periodic snapshots of the plan to complete the project, as it may change over time. If this project control tool is used properly, it will depict the construction plan to the project participants, allow management to control and measure the pace of the work, and provide the participants with the information to make timely decisions. [Trauner, 2009]

The significance of the program varies for the parties in the contract. Mubarak [2010], pointed out the benefit of project program from the contractor's and owners perspective;

Contractors need project scheduling to;

- Calculate the project completion date: to make sure that the schedule meets completion dates.
- Calculate the start or end of a specific activity: specific activities may require special attention.
- Coordinate among trades and subcontractors, and expose and adjust conflicts.
- Predict and calculate the cash flow.
- Improve work efficiency: by properly distributing workers and equipment and material.
- Serve as an effective project control tool.
- Evaluate the effect of changes.
- Prove delay claims.

Project owners and developers need project scheduling to:

- Get an idea on project's expected finish date
- Ensure contractor's proper planning for timely finish
- Predict and calculate the cash flow.
- Serve as an effective project monitoring tool.
- Evaluate the effect of changes.
- Owners may desire or require change orders.

- Verify delay claims.

2.2. Provisions of Contract

2.2.1. General

Among various types of Contract, this paper is focused on construction contract that are based FIDIC 1987 reprinted in 1992 with further amendments (FIDIC IV also called FIDIC Red Book) and PPA 2006 conditions of contract which are commonly used as a general conditions of contract (GCC). These GCCs have amendments and additional provisions to selected clauses and presented as conditions of particular applications and special conditions of contract.

The GCC of FIDIC contract (Fourth Edition 1987, reprinted in 1992 with further amendments) consists of 25 clauses; these clauses include 72 sub clauses. Likewise, a PPA 2006 condition of contract includes 62 clauses.

2.2.2. Provisions and Requirements of FIDIC 1987/1992

FIDIC 1987 reprinted in 1992 with further amendments, in the GCC, clause 14 states the detail responsibilities of the contractor to submit work program. This clause is further sub divided in to sub clauses, 14.1, 14.2, 14.3 and 14.4 where it is stated the different requirements and provisions for the contractor to comply. A review of the each sub clause is presented in the ensuing Table 4:

Table 4: [Provision of FIDIC 1987/1992 on Work Program]

Clause Reference	Clause Description
Sub Clause 14.1	Program to be submitted: states the contractor's responsibility to submit program within the specified date from the Letter of Acceptance to the Engineer for his consent, in the detail prescribed by the Engineer, the general arrangements and methods which the contractor proposed to adopt for the execution of the works.
Sub Clause 14.2	Revised program: if the actual progress of the works does not conform to the program where consent has been given by the Engineer, the contractor shall revise the program. The contractor shall also show the modifications made to such program to ensure the completion of the works with the specified time for completion.
Sub Clause 14.3	Cash flow estimate to be submitted: states the contractor's responsibility to submit a detailed cash flow estimate within the specified date from the Letter of Acceptance to the Engineer for his information. The contractor shall also revise the flow estimates at quarterly intervals, if

Clause Reference	Clause Description
	required to do so by the Engineer.
Sub Clause 14.4	Contractor not relieved of duties and responsibilities: the submission to and consent by the Engineer of the program or cash flow estimates shall not relieve the contractor of any of his duties or responsibilities under the contract.

In addition, conditions of particular application (CoPA) provide additional and detail requirements that the contractor is required to comply with while preparing the work program. From experience in the federal road projects it is observed that provision of CoPA pertaining work program is similar. Whereas, minor differences is observed from contract to contract. A sample provision of the CoPA taken from one project states, among others, the following major responsibilities of the Contractor.

- The program to be submitted is in critical path network method (CPM) network.
- Gantt/Time – bar chart
- Detailed Method statement
- Equipment and labor resources allocation
- Mobilization and delivery schedule
- Time space diagram
- Cash flow estimate and payment schedule

Detail requirements of the contract under each of the foregoing are presented in the respective section in the ensuing sections.

In addition, the CoPA also states the following responsibilities of the contractor;

- ☞ The contractor shall submit revised program.
- ☞ Submission of supplementary program

A review of the latest version of FIDIC standard conditions of contract, i.e. first edition of FIDIC 1999 in sub clause 8.3-program showed the following provision that has been included in the CoPA of the 1987/1992 version and chose to be included in the GCC;

- ☞ The contractor shall submit a detailed program to the engineer within 28 days after receiving notice to commence under the contract.
- ☞ The program or its revision shall show;

- ▣ The order in which the contractor intends to carry out the works (including the anticipated timing of each stage of design (if any), contractor's documents, procurement, manufacture of plant, delivery to site, construction, erection and testing.
 - ▣ Each of these stages for work by each nominated sub contractor
 - ▣ the sequence and timing of inspection and tests specified in the contract and
 - ▣ a supporting report including a general description of the method which the contractor intends adopt and of the major stages, and the contractor's estimation of contractor's personnel and equipment required.
- ☞ The contractor shall submit a revised programme when the program is inconsistent with the actual progress.

2.2.3. Provision of PPA Conditions of Contract

PPA in the GCC, Clause 27 states the detail provisions and requirement of work program to be submitted by the contractor. This clause is further sub divided in to 27.1, 27.2 and 27.3 that states the different requirements and provisions. A review of each sub clause is presented in the ensuing Table 5;

Table 5: [Provision of PPA 2006 on Work Program]

Clause Reference	Clause Description
Sub clause 27.1	The contractor's responsibility to submit program for the engineer's approval. The program shall show the general methods, arrangements, order, and timing for all the activities in the works.
Sub clause 27.2	The contractor's responsibility to submit program update of the program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.
Sub clause 27.3	The contractor's responsibility to submit updated program. Further, it also states that if the contractor does not submit an updated program within this period, the engineer may withheld the amount stated in the special conditions of contract.

In addition, special conditions of contract (SCC) also state the following;

“The contractor shall submit a program for the works within 28 days of delivery of the notice of acceptance”

2.2.4. Comparison of the Provision of FIDIC 1987/1992 and PPA 2006 Conditions of Contracts

Table 6: [Programming Provisions Comparison in FIDIC and PPA]

I/No	Description	FIDIC 1987/1992	PPA 2006	Remarks
1	Reference Clause	14	27	GCC
2	Submission time	Within 42 days of the receipt of the letter of acceptance	within 28 days of delivery of the notice of acceptance	In CoPA and SCC
3	Engineer's response status	Consent	Approval	GCC
4	Program updates or revision	Required at quarterly interval	Required at the interval stated in the SCC	From experience no time limit is specified in SCC in PPA.
5	Techniques and Methods to be used	<ul style="list-style-type: none"> ☞ CPM Network ☞ Gantt/Time bar ☞ Method statement ☞ Cash flow ☞ Machinery schedule ☞ Manpower schedule 	No requirement	Though no method has been proposed in PPA, the provision requires the contractor to show general methods, arrangements, order, and timing for all the activities in the works

2.3. Developing Construction Work Program

According to the PMI [2008], there is no consistency in arrangement, focus or language. Some contract requirements start right off with the software to be used along with the requirements for reports and updates, whereas, others may start with scheduler qualifications while still others introduce the purpose of the schedule and the schedule scope of work. Frequently, however, these procedures, processes and technical details are completely mixed up.

The idea is that the input, deliverables, processes and procedures that are common to many requirements irrespective of the technical portions of the specifications. Having a common framework of program requirement or program specification will lead to more consistency across contracts and will reduce confusion among the contractor community. Accomplishing general industry agreement on these factors should be more achievable and having a separate technical section may not necessarily lead to agreement on many details, but will at least lead to development of a checklist for owners to consider in their schedule specifications. Accordingly,

planning, coordination, and communication of the work plan, schedule, performance, and control are then greatly facilitated in the efforts to achieve projects successfully and profitably.

Here are some key points in the program development process suggested by PMI [2008], for ease of presentation the points are presented in the three groups of inputs, process and deliverables:

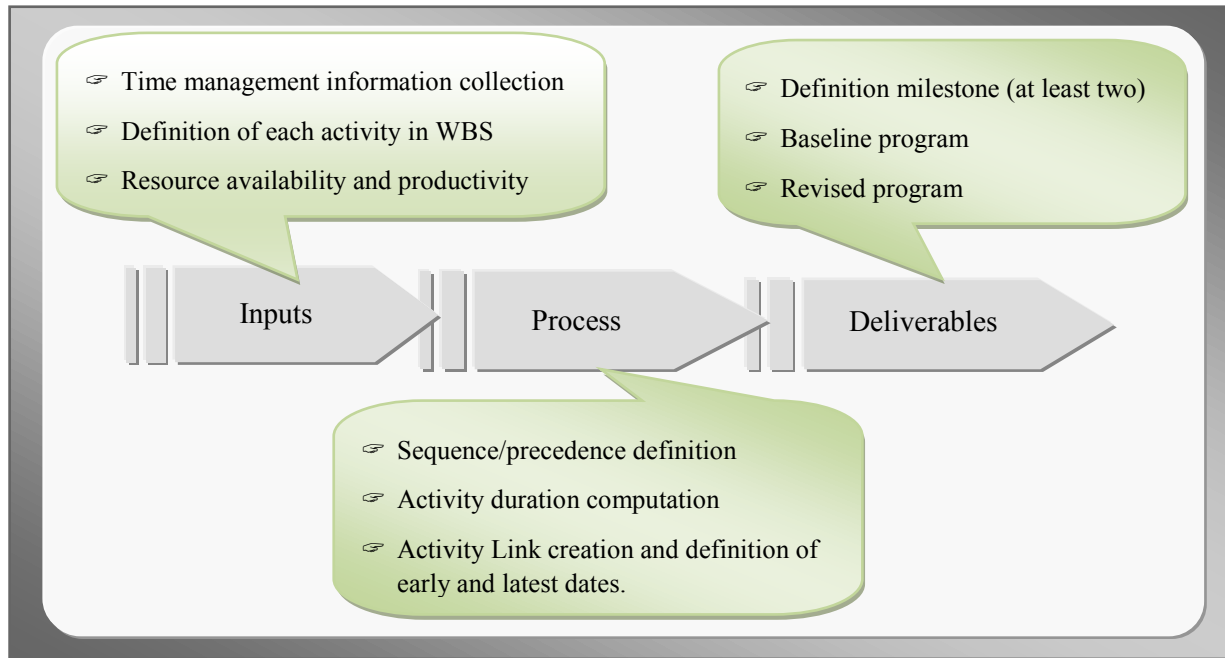


Figure 2: Work Program Development Process

2.3.1. Methods/Techniques for Work Program Preparation

One of the major features of time management tool is that the preparation of work program or schedule using different methods or techniques. There are different types of techniques used in the construction industry used to present work schedule. Trauner [2009] states that the most common scheduling techniques used for construction projects are narrative schedules, Gantt charts or bar charts, linear schedules, and Critical Path Method (CPM) schedules. He further states, the application of these scheduling methods/techniques for projects depends on; project size, project type, project complexity and owner requirements in the form of specification and conditions of contracts included in the contract.

Among the major methods, the followings are most commonly practiced techniques in Ethiopian Federal road projects;

- Method statement/Narrative Scheduling
- Bar Charts and Linked Bar Charts

- Network Analysis (CPM),
- Time Space Diagram

The above list of methods is not exhaustive and only chosen in light of the provisions of FIDIC conditions of contract and for the purpose of this paper. In addition, the methods are stand alone to represent the contractor's work program, whereas, from experience it is learnt to include few different parameters stated in the contract. In the following bullets details of the above four is presented;

A. Narrative Schedules/Method Statement

Narrative schedules are typically used on very small construction projects that have very few activities [Trauner, 2009]. A narrative schedule consists of a narrative description of the contractor's planned construction sequence and is typically submitted prior to the start of work.

In relation, FIDIC [1987/1992], conditions of contract, requires the contractor to submit narrative schedule or methods statements that includes the description of the construction methods and arrangements by which he proposes to carry out the works. In contract administered by FIDIC 1987/1992, CoPA states the detail requirements or contractor's responsibilities are listed in connection with method statement;

- ☞ A detailed work method statement in respect of each construction activity.
- ☞ It is expected to be coordinated with climatic, groundwater and other conditions to provide for the completion of the works in the order and by the time specified.
- ☞ It is expected to detail the equipment and labour resources to be allocated to each and every construction operation.
- ☞ It is expected to detail the contractor's intentions for mobilisation at the site, clearly stating deadlines for completion and delivery dates, as appropriate, and shall include but shall not be limited to:
 - i. Provision of the engineer's site facilities such as office, laboratory, housing, vehicles and surveying equipment as per the specification;
 - ii. Provision of the contractor's establishment, including offices, accommodation, workshops, secure stores, complete and, in the engineer's opinion, adequately serviced, furnished and equipped and functional in all respects;
 - iii. Provision of all equipment, staff and materials, in accordance with the Clause 14 programme, necessary to allow the Contractor to adhere to his programme.

- ☞ It is expected to show detailed work method statement of each particular construction activity shall list by category/type and quantity the labour, skilled labour, supervisors, plant, equipment and materials to be employed on the particular construction activity; together with: the estimated average daily production anticipated; the estimated equipment availability and utilisation factor anticipated; and a detailed step description of the way in which resources are to be utilised to achieve the construction.
- ☞ It is also expected to show a general description of the contractor's proposed arrangements and methods for the execution of the Works, including, inter alia, temporary offices, buildings, access roads, construction equipment and its intended production output, working shift arrangements, labour strength, skilled and unskilled, and supervision arrangements, power supply arrangements, supply of materials including a materials utilisation programme, stone crushing, aggregate production and storage, cement handling, asphalt and concrete mixing and handling, methods of excavation, dealing with water, testing methods and facilities.
- ☞ It is also expected to familiarise himself with customs procedures in connection with importation, and to allow sufficient time in its programme for these to be completed.
- ☞ It is also expected that the programme to be submitted for the execution of the Works shall, in addition to the programme of pure construction activities, environmental and social problem mitigation plan, which includes reinstating borrow and quarry site an alleviation programme for Site staff and labour in respect of Sexually Transmitted Disease (STD) including HIV/AIDS.

B. Gantt Charts/ Bar Charts

A Gantt chart, also called a bar chart schedule, visually depicts the project's major work activities in relation to time. It displays the duration and intended sequence of the tasks represented Keane [2008]. A Gantt chart or bar chart schedule is a simple and straight forward depiction of the construction plan, showing the duration and timing of the work activities with the sequence of tasks implied.

According to Wubishet and Tigist [2008] this method has been in practice since the early stages in the conceptual development time planning and still used by practitioners either by themselves or twined with CPM and PERT.

In Gantt chart presentation the major work items or activities are identified along the vertical axis, and time is tracked along the horizontal axis. The chart contains columns along the left-hand side of the page that identify the number and title of the major work activities, activity durations, and the activity start and finish dates. To the right of the columns are horizontal bars that represent the work activities described in the columns.

It is usual to observe that work activities are typically organized in descending chronological order, with the earliest work item in the first row, the next earliest work item in the second row, and so on.

Pertaining to the application, Trauner [2009] state that Gantt chart or bar chart schedule is typically used on smaller to mid-sized projects for which the relationships among the activities are obvious or easily recognized. In addition, a typical Gantt chart or bar chart schedule only summarizes the major work items and is usually only one to two pages long.

In connection with Gantt chart, FIDIC 1987/1992, in CoPA provides the contractor's responsibility to submit a Gantt/time-bar chart having the following information;

- ❖ Broken down into suitable sections detailing each construction activity,
- ❖ Showing for each construction activity;
- ❖ The periods of construction activity planned;
- ❖ The percentage completion anticipated per month;
- ❖ The total estimated quantity of work;
- ❖ The average monthly production planned; and
- ❖ The program will show both calendar days and working days.

C. Network Diagram with Critical Path Method Schedules

A critical path method (CPM) schedule is similar to a bar chart schedule in that it contains work activities that represent the project and it is simply an arrow diagram or logic network of the work activities that graphically or visually represents the construction plan. According to Wubishet et.al [2008] this version of the network diagram creates advantage over the Gantt chart because it shows the logical interrelationships or task dependencies among activities.

The linking or interdependency of the work items enables the planner to identify the critical path or the longest path of work through the network. The critical path predicts the earliest date that the project can be completed.

CPM schedules are the most frequently used scheduling technique for the planning and scheduling of construction projects, from simple to complex construction projects that require the integration of many components and incorporation of phasing and coordination.

In contracts administered by FIDIC 1987/1992, in CoPA among others states, the program to be submitted by the contractor is in the form of Critical Path Method Network (CPM Network)

showing the order of procedure and description of the construction methods and arrangements by which he proposes to carry out the works.

D. Time Space Diagram or Linear Scheduling Method

The Linear Scheduling Method which in some literatures also called Line of Balance scheduling is most effectively used to plan and manage construction projects that are repetitive or linear in nature, such as highway construction and pipeline and power line construction [Trauner, 2009]. A linear construction schedule is usually depicted as a graph with an X and Y-axis. During the presentation time is presented in the X-axis and the length/production production that is usually common to all schedule activities is plotted along the Y-axis from one end of the project to the opposite end in ascending order from the lower limit of the X-axis to its upper limit.

In linear scheduling technique the schedule activities are usually represented as a line that starts at the X-axis and that extends upward toward the upper limit of the Y-axis that depicts performance of the schedule activity along the entire length of the Project. The slope of the schedule activity line will represent the production rate of the schedule activity's operation.

The linear scheduling techniques offers advantage over the other methods as it allows the user to easily track planned and actual production rates of individual schedule activities. On the other hand its limitation is that it does not identify the critical path of the project.

In contracts administered by FIDIC 1987/1992 conditions of contract, in CoPA it is observed that this type of scheduling is requested to be submitted by the contractor. In contracts where it is not mentioned contractors were requested to submit such type of schedule by the consulting engineers.

2.3.2. Additional Submittals Included Program Clause of FIDIC

In contracts administered by FIDIC 1987/1992 conditions of contract, in GCC and CoPA, the following additional and supportive submittals are stated as a contractor's responsibilities to submit as a part of work program:

a) Cash Flow

FIDIC [1987/1992], in sub clause 14.3 of the GCC states the contractor's responsibility to submit cash flow estimate detailed cash flow estimate within the time specified and revise same quarterly, as required by the Engineer.

In addition and/or supplement CoPA states, in preparing the cash estimates, the contractor is expected to make provision for the following;

- ▣ advance payment,
- ▣ repayment of advance,
- ▣ retention,
- ▣ payment for services provided by the Employer and
- ▣ timing implications of sub-clause 60.8 - Time for Payment and Interest.

In addition in this section the contractor is also expected to show a schedule of payments expected to be made to the contractor by the employer shall be provided.

b) S-Curve

S-Curve is a display of cumulative cost, labor hours or other quantities plotted against time. The name derived from the S like shape of the curve, flatter at the beginning and end and steeper in the middle, which is typical of most projects. The beginning represents a slow, deliberate but accelerating starts, while the end represents a deceleration as the work runs out. [Midoria Media, 2015]

c) Machinery and Manpower Schedule

In contracts administered by FIDIC 1987/1992, conditions of contracts, in CoPA, states the responsibility of the contractor to submit the program that provide detail information about the equipment and labour resources to be allocated to each and every construction operation. In addition, it is also expected to show the aggregate numbers of each categories of equipment and labour, on a weekly basis, all equipment and labour required at any given time in order to allow the Contractor to adhere to the programme.

The program is also expected to show the type and mobilization program of each labor and equipment in accordance with the program prepared.

d) Material Requirement and Mobilization Program

In contracts administered by FIDIC 1987/1992 conditions of contracts, in CoPA, states the responsibility of the contractor to submit the program that provide detail information about materials requirement and mobilization in accordance with the clause 14 programme, necessary to allow the contractor to adhere to the programme.

e) Organization Structure

As an output of organizational breakdown structure (OBS) a decomposed manpower requirement is defined and assigned for each tasks.

On the other hand, the organizational structure that the project will follow in consideration of the OBS detailing the line of command, reporting line and other important information.

2.3.3. Work Programming Software

There are different software used in the programming, the single or more of the following softwares can be used in the preparation and presentation of the program:

- ☒ Microsoft project
- ☒ Primavera project planner
- ☒ Microsoft excel
- ☒ Microsoft visio
- ☒ Microsoft word

2.3.4. Developing Schedule Specifications/Requirements

After an owner or agent has chosen the proper scheduling technique, either the critical path method (CPM) and/or the bar chart method, it is important to the success of the project that specifications outlining the scheduling requirements be carefully prepared and incorporated into the contract. Including such requirements enables the employer to more effectively control and enforce the scheduling obligations of the parties involved.

Experience has shown that it is very difficult to establish standard schedule specifications for use by the construction industry today. In this regard, Jon et. al. [2002] stated that good construction work program specifications/requirements set forth the type of schedule that will be in effect for the project. Specifically, they address:

- ☞ The scheduling method and techniques to be used;
- ☞ Which party has the responsibility for preparing the schedule;
- ☞ The amount or level of schedule detail required by the specification;
- ☞ The need to incorporate all contractually specified milestones. This may include completion dates for critical components of work, deliveries of equipment, dates for promised information, dates for access to the project, and availability dates for key work areas (where renovation proceed in existing facilities);
- ☞ The need for the contractor to identify dependencies that will hold back performance;
- ☞ Processing procedures for shop drawings (preparation, submission, and approval);
- ☞ Processing procedures for submittals (initial and updates, plus frequency);

- ☞ Procedures for review and approval of the schedule;
- ☞ Remedies for noncompliance (for initial schedule as well as updates);
- ☞ Updating procedures (specifying frequency, requirements for joint updating meetings between parties, the keeping of meeting minutes, data requirements and methods for incorporating time-impact analyses and time extensions as part of the updating process);
- ☞ Progress reports;
- ☞ Whether or not the schedule will be used for determining progress payments;
- ☞ Procedures for justification of time extensions (using time impact analysis);
- ☞ Float utilization and availability to project and parties; and
- ☞ Involvement of subcontractors in the scheduling process

2.3.5. Status of Work Program

The full role of the programme in FIDIC 1987/1992 is not clear as the description of the programme in Clause 14 of the FIDIC does not specify the form that the programme should take. Although there is an obligation to submit a method statement, there is no obligation to represent the method of working stated in the method statement on the programme in the form of logic links between activities, to show the construction logic. This obligation under the contract can be satisfied by a programme in the form of a Bar Chart, together with the supporting report.

It is suggested however that the role of the programme in the FIDIC 1987/1992 is more than simply to allow progress to be monitored. The programme is not a contract document but nonetheless defines (if not creates) the obligations and rights of the parties by the dates for performance stated in the programme. [Atkinson, 2002]

A similar sentiment is also reflected by Harbans Singh in his explanation of the status of work program. Work program is not contractual in the same sense as the specification, since neither the contractor nor the employer is bound by it.

The programme is usually intended to be a flexible document. If the contractor gets behind due to any reasons, he would normally expect to revise the programme in an attempt to make up for lost time. For this reason, programmes are rarely listed as contract documents.

2.4. Factors Considered for Work Programming and Implementation

In the program development process of a project one has to consider different variables or elements for the successful preparation and implementation of the program. Different writers have

suggested their observation on the elements and factors to be included. The proper use of the elements and their practices will result in a schedule useable for planning, executing, monitoring, and communicating the delivery of the project scope to its stakeholders.

For the purpose of this paper factors suggested by different scholars are into the following three phases;

- ☞ Factors in pre-programming stage
- ☞ Factors in programming stage
- ☞ Factors in post programming stage

2.4.1. Factors in Pre-programming Stage

1. Nature, Size and Complexity of the project

The project team needs to review and understand the project's scope and project specific factors. In this element the project team will get background, information, and understanding needed to develop the program. [PMI, 2008]

Project specific factors which were affecting the preparation of better construction work schedule was the type of project which is undertaken, the nature of the project, complexity of the project and size of the project. The goal of this process is to ensure that all aspects of the project factors have been adequately understood.

2. Time

The availability of time is crucial and limiting factor in a project. A schedule must meet the project time constraints. Every project is required to be completed in a permissible duration [Sharma, 2008].

Delay in completion of project means increase in construction cost due to rise in price, payment of overhead expenses such as establishment costs, depreciation costs, indirect labor cost, etc for more periods. Depending on the provision of the contract, penalty may be applied for delay in case of contractors and delay in starting of benefits from the project to the clients of the project.

3. Manpower

Availability of suitable labors is generally, a limiting factor. [Sharma, 2008] The working hours, overtime and other incentives for improving production; and labor turnover, sickness and absenteeism are factors that has to be addressed while preparation of programs.

In addition, depending on the portions of work scope, the project may need engineering skills, procurement capabilities, construction labor, management staff, etc. in this regard, the organization breakdown structure (OBS) is a practical method to decompose the available human resources needed to execute all of the tasks into different competence areas and then into project roles, independently of the number of individuals that will be assigned the specified role. The OBS is prepared with the idea that each task in the work breakdown structure (WBS) must be assigned to a role or committee of roles. In other words, roles are allocated to detailed tasks.

4. Materials

Construction materials that are used in the construction projects. [Sharma, 2008]. Construction materials required for the execution of the project such as cement, sand, aggregate, bitumen, fuel, etc.

In most road construction projects, materials require substantial amount of money and the process of material planning requires careful attention by the project management team. In relation, the required materials quantity shall also be estimated and included as a part of planning.

5. Construction Equipment

Availability of construction equipment is normally a limiting factor, which depend on the capital involved, availability of funds, quantum of work where the construction equipment will be engaged in. [Sharma, 2008]

During planning process the capital availability is less for the purchase of equipment and work is to be completed in short duration, option for hiring equipment and/or making extra shift/extended hours of work in a shift be considered.

6. Budget/Capital

Budget/capital availability for a project is a major consideration in project scheduling as the scheduling is done with the aim of economies and timely completion of the project. [Sharma, 2008].

7. Optimum Project Update Cycle

The project management team, using the expertise of the scheduler, should determine the appropriate frequency for performing updates and status against the schedule. [PMI, 2008] This includes determining at what point in the cycle the update will occur and how often the status will be reported.

8. Work Programming Expert

It is difficult to envisage a project involving design, engineering, procurement, and/or construction which would not benefit from some form of critical path method programming or scheduling. Whilst few relatively simple projects may still be planned and managed intuitively, the rest require systematic planning and control that entails the contribution of the professional working on the planning. Different literatures frequently mention planner, planning engineer, project manager, etc while mentioning the professional involved in the planning, programming or scheduling of works.

The project work program can be developed by the project manager or planning engineer specifically assigned for the project or institution.

PMI [2008] states that in order to define the appropriate level of detail for activity definition and provision of adequate information for the ongoing control of the project, a person who knows the exactly what to be performed shall be assigned.

The programming expert is required to have knowledge requirements and management skills. In relation, Cooke [2015] the details of the requirements and management skills.

Knowledge requirements:

- ☞ To have an understanding of the various planning and programming techniques used by contractors.
- ☞ To be familiar with the company's planning software
- ☞ To understand the various stages of planning during a project: pre-tender, pre-contract and contract planning stages.
- ☞ To understand the link between programming and procurement programmes, with respect to work package subcontractors.

Management skills

- ☞ To have good presentation skills
- ☞ To prepare concise weekly and monthly reports on the contract progress situation
- ☞ To have good communication skills with all levels of the management team
- ☞ To contribute to the meeting when considering project acceleration

9. Upper Management Support

Upper management support is one important factor for implementation. It is required and important that the top management staffs back at the home office make both visible and explicit their support of execution programming processes.

They can do this by attending one or more of the schedule development sessions, by participating in feasibility planning, and strategic planning, and by using the project schedule themselves as a basis for setting priorities and making smart decisions. [Murray, 2007]

10. Contract Provision for Submission and Approval

Before the commencement of the planning, contract provision with regard to the submission responsibility of the contractor has to be considered by project planner. Accordingly, the time required to produce the program will be known and time required for planning will be estimated and complied.

2.4.2. Factors in Programming Stage

1. Choice of Programming Method/Technique(s)

The project management team or the planning expert has to decide which method(s) of the programming to be followed in the planning process. Having decided on the method, the expert will be able to organize the type of data required to be collected and/or organized.

2. Work Breakdown Structure (WBS)

Work breakdown structure is one of the factors of preparing work program or development of planning and scheduling. Keane et. al. [2008] in the book argued that for the project to be capable of being planned, programmed and controlled, it must among others includes each phase of the work is broken down into manageable tasks. This is related to simply make the project to be capable of being managed; it must have a beginning, a middle and an end. If there are no clearly defined aspiration, along with a clear definition of the project and completion criteria, uncertainty will prevail and the likelihood of arriving at an intended completion date on time will be in jeopardy.

Mubarak [2010] on his side forward supplementary idea to the above that WBS is defined as a task-oriented, detailed breakdown of activities that organizes, defines, and graphically displays the total work to be accomplished to achieve the final objectives of a project . The WBS breaks the

project down into progressively more detailed levels. Each descending level represents an increasingly detailed definition of a project component. In relation, Sharma [2008] suggests the following work breakdown structures levels, which may be work packages, activities and operations as shown in the following diagram.



Figure 3: Hierarchical Work Breakdown Structure [Sharma, 2008]

3. Identify/characterize the Project and Schedule

Every project in its nature is unique in its time of implementation, type of work, location of work and other critical parameters. Hence, every program needs to have a unique name and identification number to identify the project.

Each version of the schedule needs to have a unique version number or ID. This is essential to allow the proper archiving of project documents and audit processes. [PMI, 2008].

4. Establish Project Calendars and Work Periods

The project and activity calendars are one of the factors that are required to be completed early in the programming stage. To ensure same the planning expert in consultation with the project team, will determine the work periods which be selected for the project. PMI [2008] lists some of the calendar issues to consider include:

- ☞ Number of working days in a week

- ☞ Number of shifts to be worked each day
- ☞ Number of hours to be worked each shift or day
- ☞ Any periods of scheduled ‘overtime’ work or non-working time (e.g., holidays).

From experience, it is observed that project calendars include the following;

- Sundays
- Holidays
- Rainy season per calendar year
- Rainy days in dry season
- Non working days defined by the organization

The foregoing elements play a major role in determining the number and structure of the project calendars required for the schedule. However, while scheduling is simplified by the use of a single calendar, one calendar may be inadequate for managing the project.

In relation, FIDIC [1987/1992] states the program to be submitted is required to show calendar days and working days consider for the program development.

5. Define Milestones

Program milestones will have zero duration, will be used as bench marks to measure progress against, and can also reflect the start and finish points for various project events or conditions. As a minimum, each project must have a start milestone and finish milestone. the fact for such statement is that in a traditional design - bid - build project delivery system the contractor's deliverable is the project and hence, the start and finish events can be considered as milestone.

In addition, the milestones of the project can further increase taking into account of the breakdown provided in the WBS, i.e. in terms of work packages, activities, etc.

6. Project’s link/Logic

Connecting the activities and milestones together with project link or sensible logic is the paramount factor of work program to be developed. The method of connection is defined as a relationship. Every activity and milestone except the first and last must be connected to at least one predecessor and one successor. Ensuring compliance with this practice will prevent the schedule from containing open ends, where activities or milestones are missing predecessors or successors.

In this regard, PMI [2008] states the four activity linking methods in the following figure;

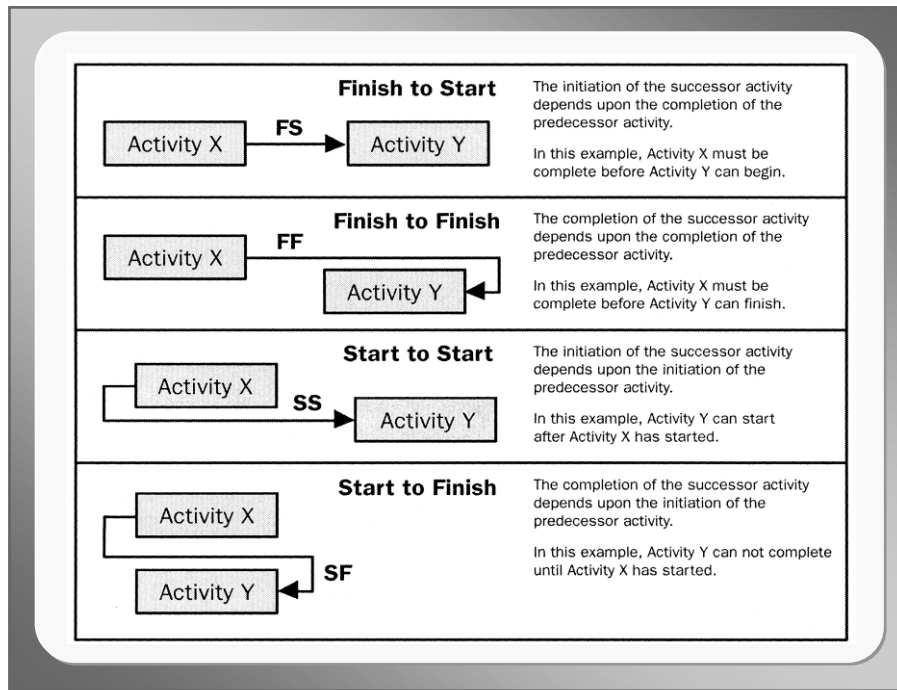


Figure 4: Project link/logic [PMI, 2008]

7. Determining the Duration for Each Activity

Activity duration determination is the paramount factor the planning expert had to critically address during the programming stage. Duration is an estimate of how long it will take to accomplish the work involved in the activity (quantity). In many cases, the number of resources that are expected to be available to accomplish an activity may determine the activity's duration. An increase or decrease to a driving resource allocated to the activity will have a effect on the duration, but this is not a simple straight line relationship.

While it is feasible to determine a duration for an activity at any time, generally accepted good practice recommends defining the activity first, then tying it logically into the overall schedule sequence and then focusing on how long it will take to accomplish the work. At this time, the relationship between the activity and other work in the schedule will be more easily appreciated; and resource flows, activity team sizes, and the like can begin to be determined[PMI, 2008]

8. Identifying the Critical Path

Once the duration of the activities is determined and the activities are linked to each other with logical manner, the project management team will be able to determine the critical path of the project with the network diagrams, CPM scheduling method.

Identifying the critical path the critical element of the programming stages that will enable the scheduler to identify the activities in the critical path and have an idea that which activity will have delaying effect on the completion date.

9. Program Risk Analysis

Program risk analysis is one of the basic factors that the planner has to consider during the program development process. Rationally, the risk analysis uses information about the uncertainty of activity durations. PMI [2008] in this regards highlights the risk analysis will help to answer the following critical questions:

- ☞ What is the likelihood of finishing the project as scheduled?
- ☞ How much contingency is needed to establish a completion date with a probability of success that is acceptable to the stakeholders?
- ☞ Which activities are the most likely to delay the project?
- ☞ What actions can be taken to control risks in the schedule?

Schedule risk analysis should be used for projects where the standard CPM durations and critical paths are viewed as risky by planners. Furthermore, the schedule risk analysis should, at minimum, address the risk event(s) identified as having a high probability and impact.

10. Other Important factors

The following important factors are also considered during programming;

- Coordination with other team members;
- Accessibility of the whole project
- Right of way requirement
- Climatic conditions
- External environment (economic, social, political, physical and technical)

2.4.3. Factors in Post Programming Stage

1. User Resistance

No amount of creative schedule design can overcome entrenched user resistance. Murray [2007] states if members of the project team are opponents of project scheduling, you may as well not waste time or money developing a CPM network at all; it will only end up in the trash anyway. The project schedule must provide them an obvious benefit if you wish for them to support its development and usage.

2. Schedule User Training

Not everyone who eventually uses the project schedule participates in its creation. In fact, the earlier participants are typically few in number or percentage, compared with all who will eventually look to the project schedule for answers.

It serves the project well to take the time to educate all of these individuals on how to read a logic diagram, how the basic calculations (earliest and latest dates, float, and critical path) are derived, and how to interpret the contents of printouts. [Murray, 2007]

3. Other Factors

In addition to the above factors the followings are also considered to be the factors that are identified to be;

- Conflicts among team members;
- Commitment of all parties;
- Continuous top management involvement;

2.5.Submission and Consent and/or Approval

As per the requirement of most contract, the contractor is expected to produce planning and submit to the consultant or project manager of the client. Likewise, in FIDIC [198/1992] and PPA [2006] conditions of contract, the contractor is expected to submit program to the Engineer.

2.5.1. Time for Submission under FIDIC 1987/1992 and PPA 2006

FIDIC [1987/1992], in Sub Clause 14.1 - Program to be submitted states that "*The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of*

Acceptance, submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works."

A sample of Part II of same clause adds the following;

"The time within which the program shall be submitted shall be the number of days stipulated in the Appendix to Bid"

Appendix to Bid in relation states, program to be submitted in within 42 days of the receipt of the letter of acceptance. Likewise, it also states the submission date of cash flow estimate to be with the same date.

On the other hand PPA [2006] conditions of contract, in Sub Clause 27.1 states; *"Within the time stated in the Special Conditions of Contract, the contractor shall submit to the Engineer for approval a program showing the general method, arrangements, order, and timing for all activities"*

Similarly the SCC states; *"The contractor shall submit a program for the works within 28 days of delivery of the notice of acceptance"*

The above being the provision of the contract, Mubarak [2010], states similar idea that program is a submittal submitted to the owner or the design professional by the contractor for approval or another action, usually a contractual requirement. Submittals are an important part of the schedule. The submittal procedure in the contract must be precise in terms of time limits.

2.5.2. The Approval/Acceptance Process

The approval process includes the assessment, response and approval/acceptance of the program by the consultant or the project manager of the client.

Assessment by the Engineer

Upon receipt of the work programme from the contractor, the Engineer has to carryout the necessary checks or assessments. In this regard, Singh [2004] states the assessment enables to ensure that the document submitted:

- ☞ Complies with the governing express contract stipulations;
- ☞ The form is acceptable;

- ☞ The contents reflect the contractual requirements and they are sufficient and complete as to the identification of the work activities, the sequencing of the work activities, the relevant milestones, etc;
- ☞ The critical activities and the critical path have been identified;
- ☞ The programming of the works is not optimistic but realistic;
- ☞ The target dates/milestones set for the contract administrator/employer as to matters such as listed hereunder are reasonable:
 - ☞ The supply of drawings, information, details, etc.
 - ☞ The provision of site possession and/or access;
 - ☞ The giving of necessary approvals, consents, decisions, etc.
 - ☞ The obtaining of the relevant easements, way leaves, etc
 - ☞ The appointment of nominated sub-contractors, third party contractors, if any, etc.;
 - ☞ The undertaking of specific obligations for the purposes of the contract e.g. delivery of employer furnished materials, etc.

Response by the Engineer

Having reviewed the contractor's work program submission the Engineer will in reference with the provision of the contract and respond within a reasonable time. The response provided by the Engineer is either;

- ☞ Withholding approval by requesting for further information
- ☞ Approving/Accepting the programme in writing, or
- ☞ Rejecting/Disapproving the programme in writing, giving reasons

Singh [2004] argues that if the Engineer fails to respond within either the stipulated period or within a reasonable period (i.e. if none is stipulated) from the date of receipt of the contractor's submission, then the work programme is deemed to have been approved or accepted by the Engineer.

Approval/Rejection by the Engineer

As one of the part of the response, the Engineer's will forward his acceptance or approval of the work programme. According to Singh [2004] the approval or consent or acceptance calls upon the following effects:

- ☞ It signifies the Engineer's agreement with the proposed order or sequence of working in the work programme.
- ☞ The approved work programme may be taken into account in any dispute for determining a reasonable order or sequence for supplying any outstanding information or details to the contractor, or for giving possession of the site by the employer.
- ☞ This is normally subject to the express caveat to the effect that the approval of the programme by the contract administrator shall not relieve the contractor or the employer from any obligation under the contract.

The other important factor is the rejection or disapproval of the program in the event that the Engineer finds the submission unacceptable, he may reject it together with the reasons for the rejection and may require the contractor to make the necessary amendments; and resubmit the programme for re-consideration.

In this regard, neither FIDIC 1987/1992 nor PPA 2006 conditions of contract being widely used in our country has express provision pertaining to the rejection or disapproval of the program.

Withholding Approval or Acceptance by the Engineer

in the case where the engineer believes is appropriate by to withhold approval, the engineer may do same having notified the contractor on the limitations of the program submitted. possible factors;

- ☞ Lack of clarity of the contents;
- ☞ Lack of sufficiency of information supplied;
- ☞ Disagreement with the reasonableness of the milestones set vis-à-vis the employer's and/or contractor's obligations; and miscellaneous matters having a material impact on the programme.

In this case, the Engineer in writing may request the contractor to submit further clarification, substantiation, satisfaction on reasonableness of the productivities, number of resources assigned, contractor's obligation, etc.

2.5.3. Consequence of Failure to Submit Program

The next question that begs an answer is as to the effect of the failure to submit and secure approval of the programme on the commencement of work.

From experience, it is observed that some contracts administered by FIDIC 1987/1992 and PPA 2006 states the Employer will withhold an amount of contractor's money for non compliance. The amount might be different from contract to contract. However, no notion of the contractor's failure to submit in the entire contract period will cause.

In this regard, Singh [2004] states the Contractor may commence execution of the works pending approval of the work programme. However, the grounds of any approval may be taken into account in determining any dispute as to a reasonable sequence or order for giving possession of the site, or for supplying supplementary drawings or details or information.

2.5.4. Factors that Contribute to the Delay in the Approval Process

From experience, it is observed that project work programs are not get submitted and approved within reasonable time. This could be associated with the following, but not limited to;

- **Delay in the Signature of the Contract:** contract signature may be delayed, which in turn affects the submission date of the program.
- **The method and level of Detail Required for the Program:** the type and number or detail submittals required to be included in the program by the contract.
- **The consultant's unlimited demand:** the consultant or the project manager of the client's may request too much and additional information to be included. Moreover, the consultant may also demand to use the software that he has very well knowledge.
- **Higher requirement of the contract:** the requirement of the submittals in the program may vary from contract to contract. The submittal requirements will be too much to comply with the time specified in the conditions of contract.
- **The time specified in the contract is not adequate:** the contractor consciously or unconsciously will not submit the program on time.
- **Disagreement with the assumptions and considerations:** the contractor and the supervisor may disagree with the assumptions and considerations that the contractor made.
- **Availability of adequate Planning Expert**

2.6.Implementation of Work Programs

2.6.1. Monitoring and Controlling of Progress

2.6.1.1. Monitoring

Project monitoring is a systematic procedure to collect and analyze information related to the implementation of the project. Monitoring provides timely information and feedback to the management regarding vital stages of the project's implementation. The basic objective of monitoring is to identify the areas where corrective action is required to be taken in order to ensure proper implementation as per plan. Mubarak [2010] defines project monitoring as observation of the project and comparing it with the baseline budget, schedule, and quality.

In supplement to the foregoing Trauner [2009] says any project with the construction work plan or schedule that is properly done and periodically updated throughout the life of the project will enable the contractor, the consultant and the owner to accurately track and measure the project's progress. Controlling and measuring the work will happen at different levels and also the owner will use the schedule to track the contractor's progress and keep the stakeholders informed of the project's status. According to Sharma, [2008] construction projects are best managed, planned and monitored by activity level in the WBS.

Monitoring is required to ensure the attainment of time and cost targets of project completion. In order to ensure these objectives, monitoring is required to cover the following functions or aspects;

- ☞ Collection of information regarding physical progress of the project. It includes the quantitative information of project activities.
- ☞ Collection of information regarding cost incurred for achieving the progress of the work.
- ☞ Comparing the progress achieved and cost incurred with the target anticipated.
- ☞ Projection of future progress and cost based on the progress achieved and resources available, and finding its effect on overall targets of completion of project of project and its revised estimated cost.
- ☞ Find out shortfall and determine reasons for the same.
- ☞ To coordinate with other departments
- ☞ Keep record of all relevant information of future use.

Efficiency and effectiveness of project monitoring depends up on the efficiency and effectiveness of the information system. Hence, effective monitoring system is required to be designated which

can help in timely identification of the warning signals for preventing cost and time overruns, and avoid slippage during the project implementation.

In this regard, in order to achieve the objectives, daily, weekly, monthly progress report format has to be designed and implemented so that progress, cost and time with reference to all the important resources like manpower, materials and equipment is recorded. The frequency of this reports will depend on the nature of the task being done and the interest of the management.

Nicholas and Stayn [2008] states that the data required to be collected and reported must relate directly to the project performance standards, i.e. to project plans, schedules, budgets, and requirements.

Further, they states the performance parameter to be monitored in this regard include;

- time progress targets
- resource productivity standards
- cost targets

FIDIC [1987/1992] in CoPA states, the contractor's responsibility for progress reporting by the Contractor should be supported on a monthly basis with an up-to-date analysis of the progress including a statement on items which are or are about to become critical to the progress of works, along with proposals on how the contractor intends to address the situation.

2.6.1.2. Project Control

Project control in the context of this paper involves the controlling of different parameters of the project such as schedule, cost, quality, safety, etc. Mubarak [2010] states that project control includes schedule control, budget control, quality control and safety control. The controlling process also involves the intervention action taken or to be taken whenever and wherever necessary.

Nicholas et. al [2008] further explained the controlling process in terms of time, cost and quality.

- ☞ **Schedule Control:** the intent is to keep the project on schedule and minimize schedule overruns. Projects can fall behind for the reason behind anyone's control.
- ☞ **Cost Control:** tracks expenditures versus budgets to detect variances, and seeks to eliminate unauthorized or inappropriate expenditures and minimize or contain cost changes. It identifies why variances occur, when changes to cost baselines are necessary, and what cost changes are reflected in budgets and cost baselines.

- ☞ **Quality Control:** is managing the work to achieve the contracted or desired requirements and specifications, taking preventive measures to keep errors and mistakes out of the work process, and identifying and eliminating the sources of errors and mistakes.

Project control starts with the measurement of work progress of the project. Measuring work progress is mainly calculating or estimating the percent complete for each activity. It may also include estimating the percent complete for the entire project.

The envisaged work progress measurement is ensured in reference with a good and updated work program or schedule of the project. In this regard, progress updates is very important to get appropriate measurement of work progress.

2.6.2. Program Revision/Updating

If the programme is to be effective as management tool it must be revised to show actual progress of activities, and revised to show changes in the construction logic and the incidence of actual events. Hence, the information to be collected should be made with great attention to ensure the accuracy of the data, which in turn becomes tool for the revision of programs.

In relation, FIDIC [1987/1992], in GCC, Sub Clause 14.2 states that when actual progress of the Works does not conform to the programme to which consent has been given under programming clause, the contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the works within the time for completion.

In addition, CoPA states the contractor's responsibility to correct or modify the programme of Work so as to take into account any delays and/or advances and modifications designs or for other reasons considered necessary by the Engineer. Further, it states that, if the Programme is to be revised by reason of the contractor falling behind his programme, he shall produce a revised programme showing the modifications to the original programme, necessary to ensure completion of the Works or any part thereof within the time for completion as defined in clause 43 of the GCC any extended time granted pursuant to extension of time clause. Any proposal to increase the tempo of work must be accompanied by positive steps to increase production by providing more labour and plant on Site, or by using the available labour and plant in a more efficient manner.

2.7. Constructability/Implementation of Programs

The purpose of developing programs is to produce a program that minimizes delay, control cost, and limit change orders. However, to envisage such objectives the practicality or constructability

of the programs is required to be well addressed. This eventually will help the user to get practical cost effective work program that paves the way to the project's success.

Implementation is the process of turning the program into ground and eventually for use. There are two basic factors to be considered during implementation, one is to install the program in the project staff environment and training the users or relevant section of the project staff. During the implementation stage the project manager or the planning department of the project is required to plan in advance so that the implementation of the program can begin as scheduled.

During the implementation stage the very basic factor is that the project manager has to follow the critical activities as priority and the remaining activities as per the available contingency. Thus, the project manager has to ensure that all the required material, manpower and equipment are mobilized in advance and the implementation has commenced as early as possible.

The other important factor during implementation of the project program is the practicality of the program for implementation. This is one factor that one has to address early during programming stage. The practicality of the program can be measured by the following parameters;

- The activities or the tasks are adequately defined through the work breakdown structure.
- Appropriate technique or method is used for the programming
- Activities or tasks are appropriately sequenced so that which has to be done before and which has to be done later has to be clearly defined.
- Assignment of proper number of construction resources, mainly equipments.
- Programs are not updates are not carried out as required.

Murray [2007] states two factors that contribute to the failure of work program;

- ☞ The Project Schedule has been commandeered by non-scheduling disciplines.
- ☞ Questionable schedule developments practices have rendered core Execution Schedule elements (scope, duration, relationship) flawed and unreliable.
- ☞ The programs submitted are not practical and implementable.
- ☞ The programs submitted are already delayed.
- ☞ The information depicted on the program does not show the actual situation.
- ☞ Change of program by the contractor.
- ☞ The resources cited on the program are not mobilized on site.

2.8. Tracking of Millstones and Deliverables

2.8.1. Milestones

Nicholas et. al. [2008] defined milestone as an event or moment in time and it is the instant when something happens. A milestone event signifies a major project occurrence such as completion of a phase or several critical or difficult tasks, approval of something important, or availability of crucial resource. As millstone events signify progress, they are important measures of project performance. Failure to pass milestone is usually a bad sign followed by changes in budget and schedule.

In light of the above, the project program is expected to assist the client's project manager and the contractor himself to track progress of the work through the milestones set.

A milestone defined by work packages may assist the project monitoring and control.

2.8.2. Deliverables

Deliverables are the milestones that define the output of an operation, activity, work package or project in the work program.

From experience, deliverables in the program are the output that the contractor is expected to provide at different stages of the implementation time line. These milestones and deliverables are;

- Start of the project
- Finish of the project
- Delivery of Engineer's facilities
- Possession of site requirements
- Surveying work
- Office engineering works
- Work package completion
- Activities completion
- Sectional completion

2.9. Review of Remedial Right

2.9.1. Overview of Remedial Right

Remedial rights are provisions entitled for non performances of the contractual obligation by the contracting parties. Such rights can be entertained considering the efforts sustained by the contracting parties in lieu of their duty to mitigate the non – performances. Among the recognized remedial rights, the most commonly known in federal road projects is extension of time. Accordingly, one of the purpose of programs is the review of remedial right.

Program as it related to Delay Analysis

Critical path method programming is the tool which identifies activities as being either critical or non-critical. The CPM program, therefore is the key to demonstrating the events which caused delays to the critical path and completion, and those which did not. While common sense and experience are essential, quantifying the impact of events must be based, in whole or in part, on sound CPM calculations.

Using CPM programmes to demonstrate delay has been used widely. A delay must be shown to be critical in order for it to be relevant for an award of time, or time-related damages. It is commonly accepted that events which delay critical tasks also delay the project completion (i.e. by extending the critical path).

Kean et. al. [2008], states CPM programmes are required to identify delay events which affect the critical path to completion, delay the project completion date and prolong the overall contract duration. On any traditional construction project, quantifying the effect of delays must be performed within a framework of CPM programming. In addition, CPM programmes continue to provide a logical and systematic method for planning the works and, regardless of how accurate/inaccurate, detailed/general, useful/useless such programmes are, they will continue to be key source documents in delay and disruption disputes.

In addition to the CPM programme other planning techniques has been also in use for the analysis of delay. Among the other techniques time space diagram or linear programming method plays considerable role in the assessment of delay claims. This due to the fact that, it is witnessed that consultants frequently use this planning method for the assessment of extension of time.

As a part of reviewing remedial right of the contractor, i.e. mainly extension of time, different methods of delay analysis has been in use. Different professionals and experts use delay analysis methods to present and review delays associated with contractor's and employer's delaying events.

There are different delay analysis methods in use worldwide. Keane et. al. [2008] presents four primary delay analysis methods stated herein below;

- Impacted as-planned,
- Time impact analysis,
- Collapsed as-built and
- As-planned versus as-built

The above four delay analysis methods are known to use critical path methods. Thus, critical path method is known to be used in all analysis methods while in different assumptions and considerations are made.

A review of delay analysis by different consultants and contractors reveals that the most widely used method of delay analysis in road construction industry is impacted as-planned method Muluken [2015]. The mere fact for such declaration is that I personally was involved in the preparation and assessment of delay claims.

Impacted as planned method of delay analysis as per SCL Protocol [2002] is based on is based on the effect of employer risk events on the planned programme of work. This is thought to be the simplest form of delay analysis using CPM techniques since it involves the least amount of variables.

The only programme required to carry out an impacted as planned analysis is a baseline programme or the master work program which is contractually compliant and represents a contractor's true intention prior to commencing any works. If the available baseline programme is not contractually compliant, or contains known and readily identifiable logical or duration errors, it may be necessary to modify the baseline prior to using it in this type of analysis.

The baseline program may not be usable in the delay analysis due to the following factors;

- Failure to use appropriate method
- Failure to identify input factors
- Failure to use realistic project link
- Failure to identify project milestones
- Failure to use realistic work breakdown structures
- The programs does not clearly show critical activities and critical path
- The programs submitted are not realistic

2.9.2. Literature Summary

In order to develop a better understanding of the research objective focusing on the provision of FIDIC 1987 Conditions of the Contract, definitions of program, factors considered in the preparation & implementation, submission & approval, monitoring of progress, tracking of deliverables, review of remedial rights and related issued are reviewed and presented.

Work programming is the program for the works indicating the logic sequence and duration of all activities to be completed by the contractors, sub contractors and suppliers in appropriate detail, for the monitoring of the progress of works.

Whereas, submission and approval of work programs also a very important issue discussed where the contractor is expected to submit the program as per the schedule specification, if any, in the contract. Then comes the approval/acceptance matter which includes the following items but may not be in its entirety, i.e submission, review or assessment by the Engineer, response, approval/acceptance, rejection, withholding approval.

Implementation of work programs is another paramount matter discussed in the literature review; the implementation is mainly discussed in terms of the use of work programs submitted by the contractors in connection with the following factors;

- Monitoring of progress
- Tracking of deliverables
- Implementation and practicality of programs
- Review of remedial rights

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This section describes all the procedures that were undertaken to achieve the objectives set for in this study. The procedures that were adopted including all the information relevant to the collection of data, where those data were obtained and how they were obtained are discussed. In addition, data and information sources, research instruments, sample size and method of analysis are presented.

The succeeding sub section provides a general description of the research strategy adopted for this thesis, as well as justification of the methodology.

3.2. Research Design

Majorly, research strategies are categorized in two types, which are: quantitative research and qualitative research. The decision in the choice of the research type is mainly depends on the type of study and availability of the information required for the study [Naoum, 1998].

Quantitative research is an objective measurement of a problem based on a theory composed of variables that can be measured in numbers; while qualitative research emphasizes meanings, experiences and descriptions to subjectively evaluate the opinion, view or perception of respondents towards a particular issue. For this research both types has been implemented, in view of the fact that it is possible to get adequate information from research questions that are related to the respondent's attitude, opinion and view coupled with desk study review of actual programme.

Hence, in order to achieve the objectives of the research, the research was carried out using the following six phase approaches.

- i) **Theoretical Exploration:** The first is to undertake a literature search on previous related publications in connection with work programming and implementation practice based on FIDIC 1987/1992 and PPA 2006 Conditions of Contract. Literature review was carried out throughout the whole research project, this was to compile and discuss information related to the thesis objectives. Many literature sources were used as primary, secondary and references such as academics periodicals, research journals, archival document within the Ethiopian Roads Authority, past dissertations and Internet resources.

- ii) **Questionnaire-** Semi-structured questionnaire was developed and distributed to the main players of the road construction project: the client (ERA), contractors and supervision consultants.

The questionnaire contains nine main sections, as listed below:

- ☞ **Section one:** contains a set of question related to the profile of the respondents in relation to institutional profile, personal information and specific experience in respective versions of FIDIC and PPA.
 - ☞ **Section two:** contains a set of questions related to the factors considered in pre-programming, programming and post programming stages of work program preparation and implementation.
 - ☞ **Section three:** contains a set of questions related to the submission and approval of work program.
 - ☞ **Section four:** contains a set of questions related to the use of work program in the monitoring of progress.
 - ☞ **Section five:** contains a set of questions related to the implementation and/or practicality of work programs.
 - ☞ **Section six:** contains a set of questions related to the use of work program in tracking of deliverables and milestones.
 - ☞ **Section seven:** contains a set of questions related to the use of work programs in the review of remedial rights with emphasis on delay analysis.
 - ☞ **Section eight:** contains a set of general questions related to the preparation and implementation of work programs.
 - ☞ **Section nine:** contains a set of questions related to the improvement and/or intervention action to be taken by parties.
- iii) **Desk study:** to examine work programmes submitted by contractors, desk study was undertaken on selected projects (for case study). In addition, detail examination has been made on correspondences, progress reports and other pertinent documents to overview the factors associated with submission and approval, implementation, progress and delay analysis.
- iv) **Data analysis and evaluation of desk study:** the data gathered from questionnaire and the case study were analysed on the basis of the objectives of the study. In addition, the current practices of work programming and implementation of the road construction projects were evaluated from the case study projects.
- v) **Conclusions and Recommendations:** from the analysis of the data as well as the literature

review, findings are developed and conclusions are formulated respective of the objectives of the study and recommendations are then made from findings. Finally, further studies related to this research are also recommended from the findings developed.

3.3. Data Collection

3.3.1. Primary Data

The source of the primary data will be in a form of questionnaire and case study projects, designed to gather adequate data from client/ERA, consultants and contractors. The primary function of the survey and desk study is to collect information that can be analyzed, and inference made to produce conclusion about work programming and implementation practice in Federal road construction projects.

3.3.2. Secondary Data

Secondary data which involves information from published text such as academics periodicals, research journals, government publications, dictionaries, past dissertations and internet resources is used to compliment the primary data.

3.3.3. Sampling

3.3.3.1. Questionnaire Sampling

A questionnaire survey was used to elicit the attitude of the main parties towards the experiences of contractors, consultants and client/ERA on work programming and implementation practice. For the fact that the topic area is very wide that need to be structured, and respondents are also required to be flexible in responding some of the questions, semi-structured questionnaire is employed in the study.

Questionnaire was developed covering the three important parameters: preparation, submission & approval and implementation of work programs. The implementation is further described in the form of monitoring of progress, tracking of deliverables, implementation and delay analysis or review of remedial rights. The questionnaire is also carefully designed in light of getting high response rate from participants. In this respect, preliminary questionnaire was distributed to five selected respondents and tested. In due course, the questionnaire had been modified incorporating the comments obtained from the preliminary test.

The alternative answers for the structured part of the questionnaire were developed based on

Likert's-scale of five ordinal measures of agreement towards each statement (from 1 to 5).

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

A Likert scale is, simply, a statement in which the respondent is asked to evaluate according to any kind of subjective or objective criteria and get opinion, or experience of respondents. In this technique, generally, the level of agreement or disagreement of respondents is measured. The reasons for adopting this simple scale are to provide simplicity for the respondent to answer and make evaluation of collected data easier. The questionnaire was sent to reputable professionals selected from contractors, client/ERA, and consultants that are considered familiar to the road construction industry in Ethiopia.

Sampling is done considering the following factor;

- There are 24 and 20 domestic and foreign contractors participating in ERA [ERA Report, 2014]. Among this contractor's questionnaire was distributed to 30 contractors actively participating for the current year.
- There are 30 classes three and above consultants actively working with ERA and questionnaire was distributed to 25 consultants.
- The Employer is one, i.e. ERA; however, questionnaire was distributed to team leaders in five regional directorates, i.e. total of 15 questionnaires was distributed.

3.3.3.2. Case Study Sampling

By the time this research is done, different Federal projects administered by ERA were under implementation. Both local and foreign contractors were involved, in addition, the supervision activities of the road projects were also carried out by local and foreign consultants.

These projects were at different stages, some are at the mobilization period, some are on the edge of completion and most projects are at the midway in contract time line. The progresses of these projects with respect to their schedule vary irrespective of the elapsed project periods. In the majority of these projects, delay was reported in comparison with contractor's master/baseline or revised work programmes.

Consequently, stratified sampling technique was used to select projects for the case study. As result, the selection of the sample projects considered the following features.

- Conditions of contract used for administration.
- Status of the project, i.e. beginning stage, mid way, at the edge of completion and completed.
- Method of procurement and origin of the contractor.

As most of the projects selected for this study are under implementation, I chose not to mention the names of the projects and hence, projects are identified with ID or numbers, for the sake of confidentiality. However, all the required data has been gathered and included in the study and annex.

3.4. Method of Analysis

In the analysis, the “Mean Score” or “Average Index” method is adopted to establish the relative importance of different factors in association with work programming and implementation. The analysis will rank the factors based on the frequency analysis and mean score/average index. This index was calculated as follows [Abd Majid & McCaffer, 1997]:

$$MS = \frac{\sum (f \times \mu)}{N} \dots\dots\dots \text{Eq. [3.4]}$$

Where:

MS – Mean Score

f – Frequency of responses for each score

μ – Weighting given to each factor by respondents (1 to 5)

N – Total number of responses concerning each factor

Whereby the application of Average Index in questionnaire for instance would be:

μ₁ = 1, frequency of “Strongly Disagree” response = Very low degree of considerations²

μ₂ = 2, frequency of “Disagree” response = Low degree of considerations

μ₃ = 3, frequency of “Neutral” response = Neutral considerations

μ₄ = 4, frequency of “Agree” response = High degree of considerations

² Degree of considerations is applied only for factors considered for work program preparation and implementation

$\mu_5 = 5$, frequency of “Strongly Agree” response = Very high degree of consideration

These average indexes could be further interpreted back to reflect the respondents, Abd Majid and McCaffer [1997] used discrete scale converted to a continuous index, which then can be split into discrete categories.

- ☞ Strongly Disagree ($0.00 \leq \text{Mean Score} < 1.5$)
- ☞ Disagree ($1.50 \leq \text{Mean Score} < 2.5$)
- ☞ Neutral ($2.50 \leq \text{Mean Score} < 3.5$)
- ☞ Agree ($3.5 \leq \text{Mean Score} < 4.50$)
- ☞ Strongly Agree ($4.5 \leq \text{Mean Score} < 5.00$)

3.5. Reporting Results

All possible factors that affect the preparation and implementation of work programs are identified and included in this research. These factors are further studied from questionnaire and case study form.

In the questionnaire part the factors are rated and ranked according to the rating scale by respondents. Whereas, in the case study, the factors are listed and studied from the documents of selected project.

In addition, improvement and intervention measures for the better preparation and implementation of work programs are also identified and reported.

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION ON RESULTS

4.1. Findings from Questionnaire

4.1.1. Introduction

This section provides explanations to the issues related to distribution of the questionnaire, collection of responses and subsequent analysis of the data acquired through the responses of professionals who are working for the client, consultants and contractors and involved in Federal road construction project in Ethiopia. The principal purpose is to rate and rank the identified variables of work programming and implementation practice and then to find out the critical factors that are required to be given due attention in order to improve the preparation and implementation practice of work programs.

Accordingly, questionnaire was developed and distributed to the main parties directly involved in the implementation of the road construction projects, i.e. the client³, contractors and consultants. Since work programming and implementation require the direct and indirect participation or contribution in the implementation stage of construction projects, respondents were selected from the three parties. i.e.

- ☞ From the client (ERA) side, team leaders,
- ☞ From consultants side, Resident Engineers, Claim Experts, Contract Engineers and Supervision Department Leaders.
- ☞ From the contractor side, Project Managers, Construction Planning Department Heads, Planning Engineers.

The questionnaire was sent to key stakeholders in the road construction industry that are considered to have direct relation with the objectives of the research. A total of 70 questionnaires were sent to a selected sample of respondents, which comprise the following: 15 client (ERA), 25 consultants, and 30 contractors; wherein the sample of the questionnaire is attached herewith in the Appendix.

4.1.2. Questionnaire Response Composition and Rating

A total of 70 questionnaires were sent to the three groups of respondents in the road construction industry; out of which, 40 questionnaires were collected, out of which 10 from client (ERA), 14

³ The client also considered to represent Donors and other Offices who have interest on the road.

from consultants, and 16 from contractors. The total response rate is 57.1%; for which and the details of the questionnaire distribution and collected percentages are shown in Figure 5 below.

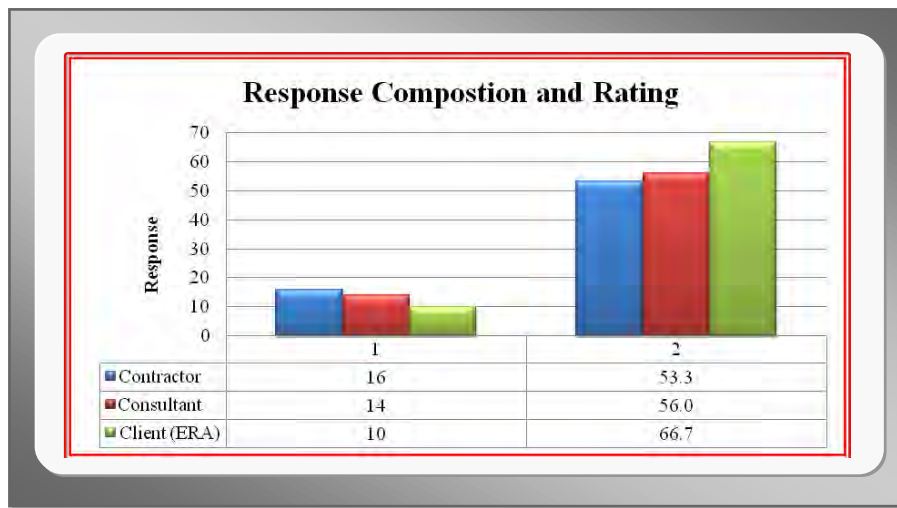


Figure 5: Questionnaire Response Composition and Rating

4.1.3. Analysis and Discussion of Results

In this section, analysis of respondents understanding and views on factors to be considered in the work programming & implementation practice, submission & approval, monitoring of progress, tracking of deliverables, review of remedial rights and finally factors that are considered to be improvement and intervention actions to be taken by contractors, consultants and the client. The responses to the questionnaire were analyzed together or the effect is measured considering the joint data obtained from all parties. The mere fact for such analysis method is that all parties are assumed to respond in reference to similar document prepared by the contractor and no sensitiviy analysis is required one party against the other. In the subsequent sections analysis and discussion is presented.

4.1.4. Respondents' Organization Establishment

Out of the 40 respondents, the data depicted below shows that 3% of the respondents organization are 5 or less years since establishment, 10% are 6 to 10 years since establishment, and 87% are more than 10 years of experience as shown in Figure 6 below.



Figure 6: Firms years since establishment

4.1.5. Respondents' Organization Experience in Federal Road Projects

Out of the 40 respondents, the data depicted below shows that 15% of the respondents' organization had 5 or less years of working experience, 18% had 6 to 10 years of working experience and 67% had more than 10 years of experience as shown in Figure 7 below.

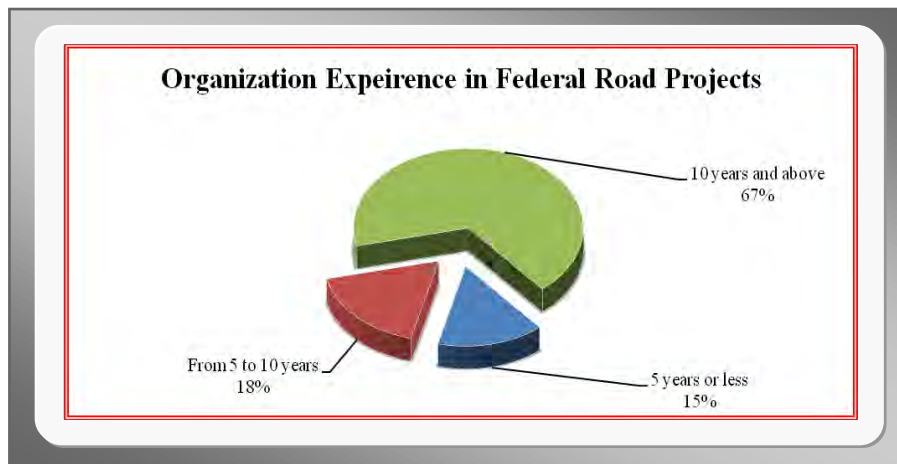


Figure 7: Respondents' Organization Experience in Federal Road Projects

4.1.6. Respondents' Personal Experience in Federal Road Projects

Out of the 40 respondents, the data depicted below shows that 10% of the respondents had 5 or less years of personal working experience, 51% had 6 to 10 years of experience and 39% had more than 10 years of experience as shown in Figure 8 below.

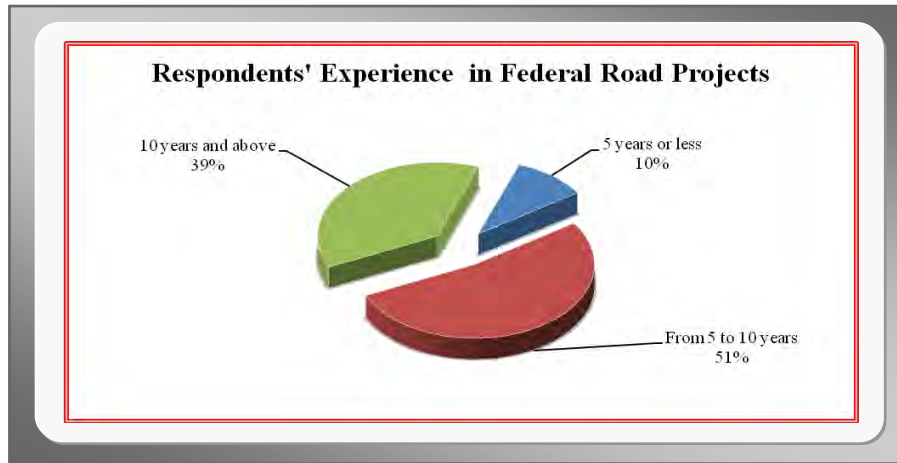


Figure 8: Respondents' personal experience in the road construction industry

4.1.7. Respondents' Experience on FIDIC and PPA Conditions of Contract

The experience of respondents on FIDIC 1987 reprinted 1992 and PPA 2006 Conditions of Contracts, from which it is noticed that substantial number of the respondents have particular working experience in FIDIC 1987 reprinted in 1992 conditions of contract, whereas, respondents experience in PPA 2006 conditions of contract shows that they have a few more than half of the respondents as shown in Figure 9 below.

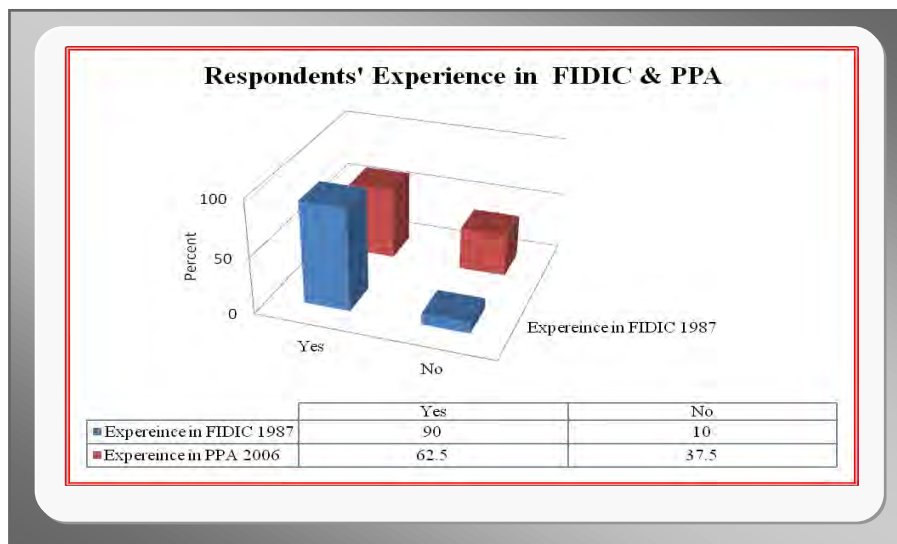


Figure 9: Respondents' experience in FIDIC 1987/1992 and PPA 2006

4.1.8. Factors Considered in Work Program Development and Implementation

Under the literature review section it is identified that different factors need to be considered while preparing and implementing work program. Accordingly, relevant questions are included in the questionnaire with the aim of checking the variables identified in the literature survey are considered or not.

The experience of respondents in relation to the factors that are considered for work program development and implementation was requested under three categories; factors in the pre-programming stage, factors in the programming stage and factors in the post programming or implementation stage. The aggregate Mean Score of the respondents is found to be as presented on Table 7 below.

Table 7: [Summary of Mean Score and Rank of Factors]

I/No	Description	Mean Score	Rank	%	Attribute
A. Pre-Program Stage					
2.1(1)	Project nature, size and complexity	4.78	2	95.5	SA
2.1(2)	Time	4.83	1	96.5	SA
2.1(3)	Manpower	4.58	5	91.5	SA
2.1(4)	Materials	4.63	4	92.5	SA
2.1(5)	Equipment and Plants	4.68	3	93.5	SA
2.1(6)	Budget/Funds	4.53	6	90.5	SA
2.1(7)	Optimum Project Program Update Cycle	3.65	10	73	A
2.1(8)	Work Programming Expert	4.10	8	82	A
2.1(9)	Upper Management Support	3.90	9	78	A
2.1(10)	Contract provision for submission and approval	4.18	7	83.5	A
B. Programming Stage					
2.2(1)	Choice of Programming Method/Technique(s)	4.33	7	86.5	A
2.2(2)	Work Breakdown Structure (WBS)	4.60	4	92	SA
2.2(3)	Identify/Characterize the Project and Schedule	4.33	7	86.5	A
2.2(4)	Establish Project Calendars and Work Periods	4.63	2	92.5	SA
2.2(5)	Define project Milestones	4.50	5	90	SA
2.2(6)	Design the Project's Logic	4.25	9	85	A
2.2(7)	Determining the Duration for Each Activity	4.63	2	92.5	SA
2.2(8)	Identifying the Critical Path	4.75	1	95	SA
2.2(9)	Program Risk Analysis	3.90	12	78	A
2.2(10)	Coordination with other team members	4.03	10	80.513	A
2.2(11)	Right of way requirement	3.98	11	79.5	A
2.2(12)	climatic conditions	4.43	6	88.5	A
2.2(13)	external environment factors	3.80	13	76	A

I/No	Description	Mean Score	Rank	%	Attribute
C. Post – Program Stage					
2.3(1)	User Resistance	3.50	5	70	A
2.3(2)	Schedule user training	3.58	4	71.5	A
2.3(3)	Conflicts among team members	3.60	3	72	A
2.3(4)	Commitment of all parties	4.23	1	84.5	A
2.3(5)	Continuous top management involvement	3.85	2	77	A

4.1.8.1. Factors in the Pre-Program Stage

As shown in Table 7 above, the factors of this category have the highest degree of consideration. Based on the result the factors, project nature, size & complexity, time, manpower, material, equipment & plant and budget have a scale between 4.5 and 5, which shows that the factors have very high degree of consideration in work program preparation during this stage according to Abd Majid et al, [1997]. Whereas, the factors optimum project update cycle, assignment of work program expert, upper management support and contract provision for submission and approval have a scale between 3.5 and 4.5, showing that the factors have high degree of considerations. The mean score of each factor is shown in the Figure 10 below.

All of these factors identified were agreed and strongly agreed by the respondents and therefore, they are very important factors considered in the pre-programming stage. According to PMI, [2008] and Sharma, [2008] the factors listed have been found to be known by respondents or have a thorough understanding and practice.

On the other hand, the rank of the factors also reveals that the factors project time, project nature, size & complexity and equipment & plant are the top three factors having relative very high degree of considerations.

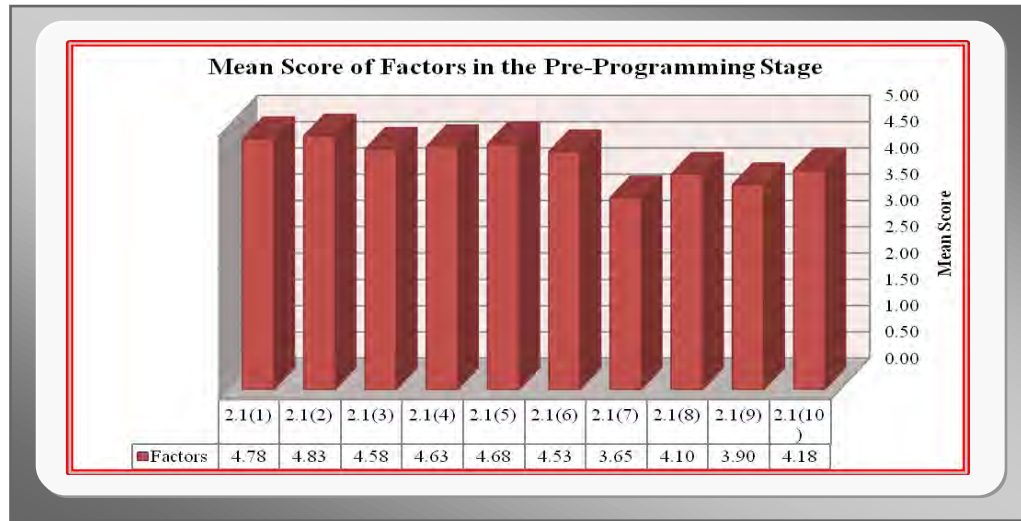


Figure 10: Mean Score of factord in pre-porgramming stage

4.1.8.2. Factors in Programming Stage

As shown in Table 7 above, like the pre-program factors, the factors of this category have the highest degree of consideration. Based on the result obtained factors; work breakdown structure (WBS), establishing project calendar, defining project milestones, determining project duration and identify the critical path have a scale between 4.5 and 5, which shows that the factors have very high degree of consideration in programming stage. Whereas, the factors choice of programming method, identify/characterize the project & schedule, design project logic, program risk analysis, coordination with other team members, right of way requirement, climatic conditions and external environment factors have a scale between 3.5 and 4.5, showing that the factors have high degree of considerations. The mean score of each factor is shown in the Figure 11 below.

All of these factors identified were agreed and strongly agreed by the respondents and therefore these were very imporant factors considered in the programming stage. According to PMI, [2008] and Sharma, [2008] the factors listed have been found to be known by respondents or have a though understanding and practice.

On the other hand the rank of the factors also reveals that the factors identifying the critical path, determining the duration of each activity and establishing project calendars are the top three factors having relative very high degree of considerations.

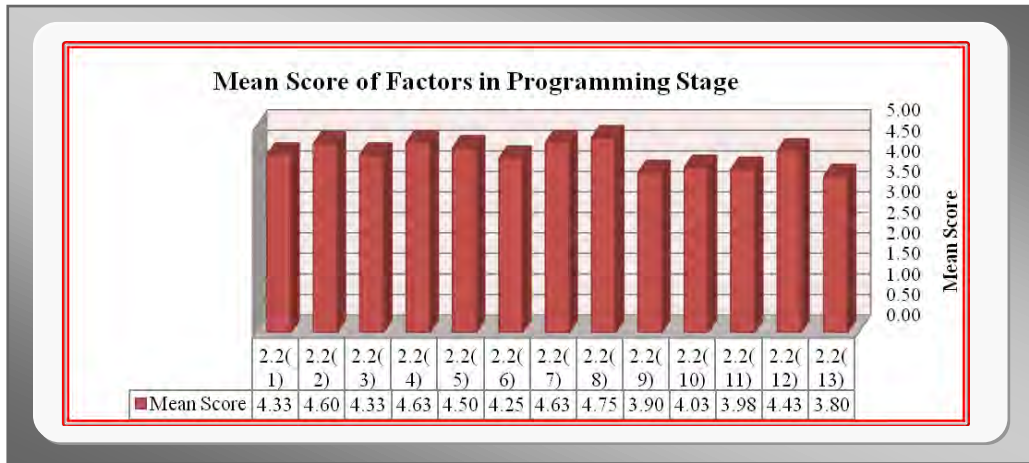


Figure 11: Mean Score of Factors in Programming Stage

Whereas, respondents revealed that the least level in the work breakdown structure are as summarized in the Table 8 below.

Table 8: [Summary of Level of Work Breakdown Structure Result]

Description of WBS Level	No of Respondents ⁴	Percentage	Rank
Project	0	0	4
Work Package	2	5	3
Activities	28	70	1
Operations	12	30	2

The response stated above shows that the lower level being used in the program development is activities taking 70% of the response rate. Next to activities, operations are also considered by 30% of the respondents.

In addition, respondents also showed that rainy seasons, Sundays, holidays, non working days of the firm and rainy days in dry season are considered in the development of program calendar. Number of respondents and rank of factors is given in the Table 9 below.

⁴ The sum of responses is more than the total number of respondents, due to the reason that respondent chose two stages as least WBS level.

Table 9: [Summary of Factors to be considered in the development of program calendar development]

Description of Project Calendar to be Considered	No of Respondents	Rank
Holiday	32	3
Sundays	33	2
Non working days declared by the firm	27	4
Rainy Seasons	37	1
Rainy days in dry season	18	5

4.1.8.3. Factors in the Post-Programming Stage

As shown in the Table 7 above, like the previous stages, factors of this category have the highest degree of consideration. Based on the result found the factors; user resistance, schedule user training, conflict among team members, commitment of all parties and continuous top management involvement have a scale between have a scale between 3.5 and 4.5, showing that the factors have high degree of considerations. The mean score of each factor is shown in the figure below.

All of these factors identified were agreed by the respondents and therefore these were very important factors considered in post-programming stage.

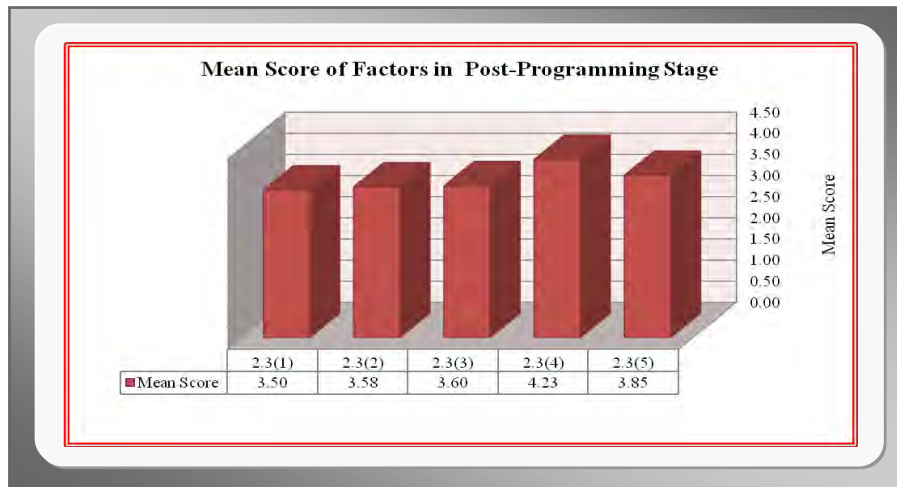


Figure 12: Mean score of Factors in Post-Programming Stage

4.1.9. Submission and Approval

It is mentioned under the literature review that different factors associated with the submission and approval process of work program. Accordingly, questionnaire under this section are developed with the aim of checking the variables identified in the literature survey in the industry.

The result obtained in this section as shown in Table 10 and Table 11.

Table 10: [Summary of Methods Used in Work Program Preparation]

I/No	Description	Total No of Respondents (A)	Percentage from Total (A/Total No)*100	Rank
1	Method Statement	37	93	2
2	Gantt Chart/Time Bar Chart	38	95	1
3	Network Diagram CPM	24	60	10
4	Time Space Diagram	25	63	9
5	Cash Flow	34	85	5
6	S-Curve	28	70	7
7	Organization Structure	26	65	8
8	Machinery Requirement and Delivery Schedule	35	88	4
9	Manpower Requirement and Delivery Schedule	36	90	3
10	Material Requirement and Delivery Schedule	33	83	6

Table 11: [Summary of Issues in the Submission and Approval]

I/No	Questions	Mean Score	Description
1	The requirements (methods and specific requisite) of the contracts concerning work program are sufficient and exhaustive?	3.61	Agree
2	The time specified in the Conditions of contract (FIDIC 1987 and PPA 2006) for the submission of work program is sufficient?	3.38	Neutral
3	Contractors submit and get approval/acceptance for their Work Programmes within the period specified in the Contract.	2.4	Disagree
4	Contractual remedies are set in the conditions of Contracts for the failure to submit work programmes within the specified period are sufficient and enforceable.	2.73	Neutral
5	Do the contracts you are involved have program specification/requirement in the contract?	3.95	Agree

4.1.9.1. Methods or Techniques of Work Program Preparation

From the result shown in the above table it can be seen that the top six methods being used with most of the respondents are Gantt chart, method statements, manpower requirement & delivery schedule, machinery requirement & delivery schedule and cash flow, material requirement & schedule. The result obtained complies with the schedule specification stated in standard and particular conditions of contract of FIDIC, [1987/1992]. On the other hand, the methods, S-curve, organization structure, time space diagram and network diagrams are ranked from 7 to 10 in respective order, showing that the relative use of these methods are less compared to the first six factors.

4.1.9.2. Requirements of the Contract

Respondents showed their stand by agreeing with the sufficiency and exhaustiveness of the requirements (methods and specific requisite) of the contracts concerning work program.

4.1.9.3. Time Specified in the Contract

Most of the participants have shown biased stand on the sufficiency of the time specified in the Conditions of contract (FIDIC 1987 and PPA 2006) for the submission of work program. This due to the fact that the response obtained from respondents showed that they have equivalent view corners on the sufficiency of time specified in the Contract.

Respondents who perceive that the time specified is not enough identified the factors stated below from similar projects experience. The factors are listed two groups;

Time Related

- The time provided is not enough to submit detail work program
- The time stated in the contract is very short and during such time the contractor may not be able to identify construction material.

Contractor Related

- Delay in the signing of the contract and waiting the contract signature for the preparation of program.
- Contractor has to study the design, contract provisions and the project area the preparation of work program.

4.1.9.4. Submission and Approval

Respondents showed their disagreement with the statement; Contractors submit and get approval/acceptance for their work programmes within the period specified in the Contract. The result shows, that there are factors that prevent the contractors from submitting and getting the appropriate approval.

Respondents who perceive that, contractors do not get approval in the time specified in the contract have identified the factors from similar projects as indicated in Table 12 below.

Table 12: [Summary of Factors that delay the submission and approval of Work Program]

Description of Factor	Total	Rank
The requirement stated in the contract is higher	3	5
Consultants and Employer's comments and unlimited demand	12	3
The time specified in the contract is not adequate	8	4
Disagreement with the assumptions and considerations	18	2
Absence of programming expert in each parties	22	1

In addition, participants have also forwarded the following factors;

- ☞ No attention is given to its preparation and timely submission
- ☞ Lack of commitment from the contractor and from the consultant to act on time
- ☞ Contractors submit program that they do not implement
- ☞ No attention is given schedule than formality purpose

From the result observed above it is observed that the submission and approval delay is mainly related to lack of expertise, disagreements in assumptions and unlimited demand and comment by the Consultant and client.

4.1.9.5. Contractual Remedies for Failure to Submit Work Program

Respondents have shown biased stand on the sufficiency and enforceability of the remedies stated in the conditions of contract (FIDIC 1987 and PPA 2006) for failure to submit and update work program. The result showed that respondents have biased view on the sufficiency and enforceability of contractual remedies.

Respondents, who perceive that the contractual remedies set out in the contract are not sufficient and enforceable, have identified their arguments as detailed below;

Contract Document Related

- ☞ No clearly specified penalty for failure to submit
- ☞ Remedies specified are only withholding small amount of money and this has to be increased
- ☞ Remedies should be high in amount
- ☞ The program should be precedent condition for commencement of work
- ☞ The amount specified in the contract is insignificant compared to the scope of work and the importance of schedule.

Contractor Related

- ☞ The contractor opt to be penalized than submit work program
- ☞ The contractor should not be allowed to commence the work or substantial amount of money has to be withheld.
- ☞ Contractual remedies has to be taken for the delay recorded.

4.1.9.6. Program Specification/Requirement in the Contract

Respondents have shown their agreement on the contract to have included program specification/requirement. The result showed that respondents believe that the conditions of contract or any other section of the contract to include requirements that dictate and instruct the contractor to prepare work program.

Respondents, who perceive that contracts provide program specification listed out the following factors from experience in their projects in the Table 13.

Table 13: [Summary of program specification response]

Specification / Requirement	Total No of Respondent	Rank
The program method/techniques to be used;	34	1
The level of program detail required by the contract	25	4
The need to incorporate all contractually specified milestones. (provision of facilities, deliveries of equipment, dates for access to the project, right of way requirement)	29	2
Procedures for shop drawings (preparation, submission, and approval);	25	4
Procedures for submittals (initial and updates, plus frequency);	22	6
Procedures for review and approval of the schedule;	26	3
Remedies for noncompliance;	14	8

Specification / Requirement	Total No of Respondent	Rank
Updating procedures (specifying frequency);	19	7
Whether or not the schedule will be used for determining progress payments;	4	11
Procedures for justification of time extensions (using time impact analysis);	11	9
Float utilization and availability to project and parties; and	6	10

The table above provides that the program method/techniques to be used, the need to incorporate all contractually specified milestones and procedures for review and approval of the schedule are the top three factors agreed to be specified in the respondedents contracts.

4.1.10. Monitoring of progress

It is mentioned under the literature review that work programs are usable in the monitoring of progress. Accordingly, questionnaires under this section are developed with the aim of checking the variables identified in the literature survey are implemented.

The experience of respondents in relation to the monitoring of progress is presented in the following Table 14;

Table 14: [Summary of Factors in the Monitoring of Progress]

I/No	Questions	Mean Score	Description
1	The programs submitted by contractors will assist to monitor the progress of projects and identify the areas where corrective action is required to be taken in order to ensure proper implementation:	3.3	Neutral
2	Contractors use reporting system that compares program versus executed for the efficiency and effectiveness of project monitoring.	3.75	Agree
3	Work Programmes are revised and submitted to communicate actual status of the project.	3.18	Neutral
4	Work Programmes are revised and submitted as per the time specified or as required by the progress of the project.	2.69	Neutral

4.1.10.1. Work Programs for Monitor the Progress of Projects

Most of the participants have shown biased stand towards the statement, the programs submitted by contractors will assist to monitor the progress of projects and identify the areas where corrective action is required to be taken in order to ensure proper implementation. This due to the fact that the

response obtained by the respondents showed that they have equivalent view corners.

Respondents, who perceive that the program will not assist the progress monitoring, stated the following factors from experience in the Table 15 below.

Table 15: [Summary of Factors that Affect the Use of Work Program for Progress Monitoring]

Factor	Total	Rank
The programs are not realistic (logic design, method, WBS, ...)	17	1
The programs are not updated as required.	15	2

On the other side, respondents who perceive that the program will assist the progress monitoring, stated the following factors stated in the Table 16 from experience.

Table 16: [Summary of Factors that are Monitored Using Work Program]

I/No	Factors to be Monitored	Total	Rank
1	Time Progress	19	1
2	Cost Progress	14	2
3	Resource Productivity	14	2
4	Manpower Productivity	11	4
5	Material Consumption	11	4

From the result in the table above it is learnt that portion of the respondents use work program for time progress, cost progress and resource productivity monitoring as argued by Nicholas and Stayn [2008].

4.1.10.2. Reporting System for Progress Monitoring

Respondents showed their agreement with the fact that contractors use reporting system that compares program versus executed for the efficiency and effectiveness of project monitoring.

Respondents who perceive that contractors will use reporting system also indicated the report system being experienced as shown in the Table 17 below.

Table 17: [Summary of Report Frequency]

Description of Frequency	Total No of Response	Rank
Daily	2	3

Description of Frequency	Total No of Response	Rank
Weekly	8	2
Bimonthly	0	4
Monthly	29	1

From the table above it is noted that the most used reporting type is monthly progress report followed by weekly and daily report.

4.1.10.3.Revision of Work Programs

Respondents showed their neutral or biased response (mean score of 3.18); with the fact that work programmes are revised and submitted to communicate actual status of the project.

Respondents have also showed neutral or biased position on the work program revision and submission as per the time specified in the contract document, which is similar to the result obtained for submission of baseline program discussed above.

4.1.11. Practicality and Implementation of Work Programs

It is mentioned under the literature review that the implementation and practicality of work programs discussed in terms of different variables. Accordingly, questionnaire under this section are developed with the aim of checking the variables identified in the literature survey in connection with the practicality of work programs.

The experience of respondents in relation to the implementation and practicality of work programs is presented in the following Table 18;

Table 18: [Summary of measure of work program as implementation guidance]

I/No	Questions	Mean Score	Description
1	The work programs submitted by contractors are used as implementation guidance/the programs are practical or not.	3.33	Neutral

4.1.11.1.Work Program as Implementation Guidance

Respondents have also showed neutral or biased position on the use of work program as implementation guidance. The response of the participants is divided in to two where in one corner they believe that the program will be used as implementation guidance, whereas the remaining

respondents stand on the flip side.

Respondents, who perceive that work program will not be used as implementation guidance highlighted the following factors from experience in the Table 19 below.

Table 19: [Summary of factors that affect the implementation of work program]

Factor	Total No of Respondent	Rank
The programs submitted are not practical and implementable	9	2
The programs submitted already delayed	8	3
The information depicted on the program does not show the actual situation	6	5
Change of program by the contractor	8	3
The resources cited on the program are not mobilized on site	11	1

Participants highlighted that the program will not be used as implementation guidance due to the facts ranked in the foregoing table. Among the factors the resources are not mobilized on site accounts highest portion and the program itself is not practical and implementable will follow.

4.1.11.2. Factors that are Required to Measure the Practicality of Program

The result collected from respondents showed that there are factors that are used for the measure of work program practicality. The factors are listed under Table 20.

Table 20: [Summary of factors used to measure practicality of program]

Factors	Total No of Respondents	Rank
The activities or the tasks are adequately defined through the work breakdown structure.	32	4
Appropriate technique or method is used for the programming	34	3
Activities or tasks are appropriately sequenced so that which has to be done before and which has to be done later has to be clearly defined.	37	1
Assignment of proper number of construction resources, mainly equipments.	35	2
Program updates are not carried out as required	20	5

From the responses of the respondents it is learnt that assignment of proper number of construction resources, (mainly equipments), activities or tasks are appropriately sequenced so that which has to be done before and later has to be clearly defined and appropriate technique or method is used for

the programming are the three most important factors identified by Murray [2007].

4.1.12. Tracking of Deliverables and Millstones

It is mentioned under the literature review that work programs are usable for the tracking of deliverables and millstones. Accordingly, questionnaire under this section are developed with the aim of checking the variables identified in the literature survey for the tracking of deliverables are implemented.

The experience of respondents in relation to the tracking of deliverables is presented in the following Table 21;

Table 21: [Summary of results of tracking of deliverables]

I/No	Questions	Mean Score	Description
1	Work programs submitted by the contractors define project deliverables and milestones to the required level by the contract.	3.18	Neutral
2	Contractors usually achieve the milestones and deliverables set out in the work programs.	2.1	Neutral
3	Work program submitted by the contractor usually used in the tracking of deliverables	2.9	Neutral

4.1.12.1. Define Project Deliverables and Milestones

Respondents showed neutral response on the factor that programs submitted by contractors define deliverables and project milestones to the required level in the contract.

On the other hand, respondents showed neutral or biased response on the achievement of the milestones and deliverables set out in the work programs.

4.1.12.2. Tracking of Deliverables

Respondents provided neutral or biased response on the use of work programs submitted by contractors for the tracking of deliverables.

Respondents that disagree with the use of work program to track deliverables stated the factors stated in the Table 22 below.

Table 22: [Summary of reasons why work programs are not used for tracking of deliverables]

I/No	Factors	Total No of Respondents	Rank
1	Failure to define project deliverables	12	2
2	Failure to update the program	16	1
3	The contract documents does not clearly define project deliverables	5	4
4	No intention by the contractor to describe such commitment dates	10	3

The result of the above table reveals that the factors, failure to update work program and failure to define project deliverables in the program are the top two factors initiate the respondents to disagree.

4.1.12.3. Milestones

Respondents were requested to reflect the milestones used in their work programs and the result are shown in the Table 23 below.

Table 23: [Summary of milestones defined in the work program]

I/No	Milestone Description	Total No of Respondents	Rank
1	Start of the Project	37	1
2	Finish of the project	34	2
3	Delivery of Engineer's Facilities	20	5
4	Possession of site requirements	25	4
5	Surveying work	17	6
6	Office engineering works	13	8
7	Work package completion	14	7
8	Activities completion	27	3
9	Sectional completion	9	9

Respondents showed that start of the project, finish of the project and activities completion are the three top factors that most of the respondents include in their work programs.

4.1.13. Review of Remedial Rights

It is mentioned under the literature review that work programs are used in the review of remedial rights mainly delay analysis and determination of extension of time. Accordingly, questionnaire under this section are developed with the aim of checking the variables identified in the literature survey for the review of remedial rights are being used.

4.1.13.1. Methods or Techniques Used in Delay Analysis

Respondents were requested to list the method or technique they used in the delay analysis and claiming and analyzing extension of time claims and the responses are shown in Table 24 below.

Table 24: [Work program methods used in delay analysis]

I/No	Specification or Requirement	Total No of Respondents	Rank
1	Method Statement	15	4
2	Gantt Chart/Time Bar Chart	25	1
3	Network Diagram CPM	19	2
4	Time Space Diagram	14	5
5	Cash Flow	11	7
6	S-Curve	8	9
7	Organization Structure	3	10
8	Machinery Requirement and Delivery Schedule	17	3
9	Manpower Requirement and Deleivery Schedule	12	6
10	Material Requirement and Delivery Schedule	11	7

From the results shown in the table above it is learnt that Gantt chart, Network diagram CPM and Machinery requirement and delivery schedule are the top three methods used in the delay analysis and extension of time preparation and request.

Respondents showed biased response towards the use of work programs prepared by the contractor to assist delay analysis as shown in the Table 25 below;

Table 25: [Summary of Response for work program to assist delay analysis]

I/No	Questions	Mean Score	Description
1	Researches show that Impacted as planned method is the most frequently used delay analysis method in Ethiopian Federal road projects. Do the work programs prepared by the contractor assist for such delay analysis techniques?	3.1	Neutral

Respondents that disagreement biased position towards the use of work program in the delay analysis were requested to highlight the associated factors and presented in the Table 26 below.

Table 26: [Summary of factor that describe why work programs do not assist delay analysis]

I/No	Factor Description	Total No of Respondents	Rank
1	Failure to use appropriate method	12	1
2	Failure to identify input factors	6	5
3	Failure to use realistic project link	12	1
4	Failure to identify project milestones	6	5
5	Failure to use realistic work breakdown structures	9	3
6	The programs does not clearly show critical activities and critical path	5	7
7	The programs submitted are not realistic	9	3

Respondents showed that the factors failure to use appropriate method, failure to use realistic project link, failure to use realistic work breakdown structures and the programs submitted are not realistic are the top four factor that are identified by respondents to have affected the use of work programs in the use for delay analysis.

4.1.14. General Practice of Work Program Preparation and Implementation

Under this section general questionnaires are presented to check the attitudes of respondents on the general practice of work programming and implementation practice in federal road projects. The Mean Score of the agreement/disagreement of respondents is presented in Table 27 below.

Table 27: [Summary of participant’s response to general question]

I/No	General Factors	Mean Score	Description
1	Contractors give sufficient emphasis for work programming.	2.40	Disagree
2	Some professionals states that “Contractors present work programmes for the sake of contractual requirements.” What is your view on this conclusion with respect practice?	4.05	Agree
3	Professionals states that work programming practice by foreign contractors is by far better quality than the domestic contractors. What is your view on this conclusion with respect practice?	3.63	Agree
4	Projects with properly done work programs have a better progress than those with no programs or defective programs.	3.83	Agree
5	Work program submitted by the contractor is considered as part of contract document or it will take a status of contract.	3.46	Neutral

As it is shown in Table above, the following results were found;

- ☞ Respondents have revealed their disagreement on the sufficiency of the emphasis given by contractors on work programming.
- ☞ Respondents also agreed on the conclusion accepted by a great number of researchers in

the international level stated as: ‘*Most contractors present work programmes for the sake of contractual requirements.*’

- ☞ Respondent have also showed their agreement on work programs submitted by foreign contractors are better than the programs submitted by domestic contractors.
- ☞ Respondents have also showed their agreement on the factor projects with better work programs have better progress.
- ☞ Respondents showed biased response to the factor that work program submitted by the contractor is considered to be a part of the contract.

4.1.15. Improvement Action/Suggestions

It is mentioned under the literature review that there are many factors suggested as improvement actions to improve the preparation and implementation of work programs. Accordingly, questionnaire under this section are developed with the aim of checking the variables identified in the literature survey are considered by respondents.

Table 28 below showed the list of methods of improvement that could be considered in work program preparation and implementation in the federal road projects. Respondents show different opinion towards these methods of improvement.

Table 28: [Improvement actions in preparing and implementation of work programs]

I/No	Improvement Factor	Yes		No	
		Frequency	Percentage	Frequency	Percentage
	A. General				
1	Improve the contract management practice of				
	- Contractor	39	98	1	3
	- Consultant	39	95	2	5
	- Employer	38	95	2	5
	B. Contractor’s Related				
2	Assignment of proper professional for the planning and programming	39	98	1	3
3	Provision of training to project management team	38	95	2	5
4	Project planners should communicate all project participants	35	88	5	13
	Continuous and proper planning before construction, so that resources and time are sufficient	37	93	3	8

I/No	Improvement Factor	Yes		No	
		Frequency	Percentage	Frequency	Percentage
5	Conduct continuous monitoring to get information and feedback for project updates	39	98	1	3
6	Contractors should manage their financial resources and plan cash flow	39	98	1	3
7	Implementation of Management information system	37	93	3	8
8	Assign sufficient number and type of resources	40	100	0	0
9	Understand the contractual implications of the non compliance	38	95	2	5
	C. Employer's Related				
1	Include realistic requirement for the preparation of work programs	36	90	4	10
2	Define project program requirement and specification and include in the contract	36	90	4	10
3	Put realistic submission and approval date in the conditions of contract	36	90	4	10
4	Show commitment to the contractor's program	36	90	4	10
5	Allocate practicable project durations	36	90	4	10
6	Include strong and enforceable contractual remedies for non compliance	36	90	4	10
7	Develop applicable productivity/output standards	37	93	3	8
	D. Consultant's Related				
1	Forward comments, approval and withdrawal of approval within reasonable time	40	100	0	0
2	Avoid unrealistic comments	37	93	3	8
3	Improve the capacities of project team in work programming	39	98	1	3
4	closely monitor the progress of the project and take the contractual measures	40	100	0	0

4.1.16. Suggestion as Measure to Improve the Preparation and Implementation of Work Programs

At the end of the questionnaire respondents were requested to express their comments and suggestions on the overall practice of work programming and implementation practice to point out

what to be expected from the stakeholders in the construction sector, in road construction projects in particular. Accordingly, participants pointed out expectations from stakeholders described as follows.

Contractors

- ☞ Contractors are expected to prepare realistic work program with the aim of executing the project within the time specified in the contract.
- ☞ Contractor should assign efficient site personnel to practice and evaluate the work programs.
- ☞ Contractors should have awareness on the importance of work program.
- ☞ Contractor should show commitment to the program submitted.

Client (ERA)

- ☞ The client should assign project engineers on routine follow up of the reported plan –actual relation on realistic basis.
- ☞ Consider the submission of program in evaluating performance of the project.
- ☞ Encourage contractors with better project management system.

Consultants

- ☞ Consultants should know different methods of work program preparation so that realistic comments can be forwarded.
- ☞ Consultants should monitor the progress and advise the contractor to revise.
- ☞ Consultant should take enforceable measures.
- ☞ Consultant should assign experienced professionals on spot and forward realistic comments.

Conditions of Contract

- ☞ Remedies for failure to submit work programs should be clearly stated.
- ☞ Submission of work programs to the requirement quality shall be set as a precedent condition for the release of mobilization advance payment and commencement of permanent works.

4.2. Findings from Case Study

Investigations were made through desk study on selected projects for case study. The analysis of the case study is presented under the subsequent sections. The data and information taken from each project is baseline work program, progress report and correspondences.

Table 29: [Case Study Project ID No 1]

Case Study: Project ID No 1 ⁵			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> WBS, Choice of program method, establishment of project calendar, milestones are partially defined, <input checked="" type="checkbox"/> Durations determination, right of way requirement, climatic conditions, external factors are missing. <input checked="" type="checkbox"/> Activities are in the bottom position of the WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available.
2	Submission time	Within 42 days of receipt of the letter of acceptance	Within 89 days from the letter of acceptance, this is 47 days delayed.
3	Contractual remedies for failure to submit	Not Specified	No action was taken
4	Acceptance /Approval	Not specified	After the 89 days delayed submission, the program was commented and the contractor resubmitted the program. The re-submitted program on was provisionally or for monitoring purpose accepted.
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment allocation ☞ Labor allocation ☞ Cash flow 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Linked bar chart <input checked="" type="checkbox"/> Method statement <input checked="" type="checkbox"/> Organizational structure <input checked="" type="checkbox"/> Manpower schedule <input checked="" type="checkbox"/> Machinery distribution <input checked="" type="checkbox"/> Material supply schedule
6	Revision	Revision required at quarterly interval	Revised two times, more than 10 months time interval
7	Failure to mobilize in accordance with	Default of the contractor	No action was taken by the Engineer and Employer.

⁵ Project data if the project is attached as annex.

Case Study: Project ID No 1⁵			
I/No	Parameters	Contract Provision	Observation
	the program		
8	Milestones	<ul style="list-style-type: none"> ☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery 	Except equipment and manpower delivery the required milestones are shown.
9	Monitoring	N/A	The program submitted has been used to monitor time target, cost target, productivity, etc. However, due to the delay in the submission of updated program, the program at hand is not being used for monitoring of progress.
10	Practicality and implementation	N/A	It was observed that the program satisfies the requirement stated in Murray lists. Hence, it can be said that the program is implementable and practical.
11	Delay Analysis	Not specified	<p>The program is not usable for delay analysis, as the program does not have clear critical path and the logic is not defined as required.</p> <p>The time extension requests presented by the contractor were reviewed and it was learnt that neither the submission nor the assessment was done using work program</p>

Table 30: [Case Study Project ID No 2]

Case Study: Project ID No 2 ⁶			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years. 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Choice of program method, establishment of project calendar, milestones, durations determination, right of way requirement, project logic, identifying critical path, climatic conditions, external factors are missing. <input checked="" type="checkbox"/> Operations are the in the bottom level of the WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available
2	Submission time	Within 42 days of receipt of the letter of acceptance	Submitted within 47 days from the letter of acceptance, which is 5 days delayed from the contract requirement.
3	Contractual remedies for failure to submit	With held 50,000 birr per week of a delay	No remedies/action was taken for baseline as well as revised work program
4	Acceptance /Approval	Not specified	The program was reviewed and commented by the Engineer. After 88 days from the letter of acceptance, the program was accepted. Records show that the program was commented by the Engineer several times, which is related to the quality of program submitted.
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment allocation ☞ Labor allocation ☞ Cash flow 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Linked bar chart <input checked="" type="checkbox"/> Manpower schedule <input checked="" type="checkbox"/> Machinery schedule <input checked="" type="checkbox"/> Cash flow (incomplete) <input checked="" type="checkbox"/> Work load

⁶ Project data if the project is attached as annex.

Case Study: Project ID No 2⁶			
I/No	Parameters	Contract Provision	Observation
6	Revision	Revision required at quarterly interval	Revised three times, at 4, 10 & 11 months interval from the approval date of the Engineer
7	Failure to mobilize in accordance with the program	Default of the contractor	No action was taken by the Engineer and Employer.
8	Milestones	☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery	Except equipment and manpower delivery the requested milestones are shown.
9	Monitoring	N/A	The program submitted has been used to monitor time target and cost target. However, due to the absence of approved and updated work program, it has created difficulty in the monitoring work.
10	Practicality and implementation	N/A	It was observed that the program lacks logic and definition of critical path, lack of updating and the use of appropriate technique, hence, it can be said that the program is not practical, as it does not satisfy the Murray's list. However, the revised submissions are practical and realistic.
11	Delay Analysis	Not specified	The program is not usable for delay analysis, as the program does not have clear critical path and the logic is not defined as required. The time extension requests presented by the contractor and the review made by the engineer was not made work program.

Table 31: [Case Study Project ID No 3]

Case Study: Project ID No 3 ⁷			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years. 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Choice of program method, milestones, right of way requirement, identifying critical path, external factors are missing. <input checked="" type="checkbox"/> Operations are in the bottom level of the WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available
2	Submission time	Within 42 days of receipt of the letter of acceptance	Submitted within 76 days from the letter of acceptance, which is 34 days delayed.
3	Contractual remedies for failure to submit	With held 50,000 birr per week of a delay	The Engineer withheld some amount for non compliance in submitting the program. However, the amount has been released to up on the submission of the program.
4	Acceptance /Approval	Not specified	<p>The program was reviewed and commented by the Engineer. After 94 days from the letter of acceptance, the program was accepted.</p> <p>Review of the records show that some of the comments forwarded by the engineer was not in line with the provisions of the contract.</p> <p>In addition it is also learnt that the Engineer and the contractor has not agreed on the contractor's assumption.</p> <p>Finally, the Engineer gave his approval stating his reservation on the output of three activities.</p>
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Method statement <input checked="" type="checkbox"/> Bar chart <input checked="" type="checkbox"/> Work load <input checked="" type="checkbox"/> Cash flow

⁷ Project data if the project is attached as annex.

Case Study: Project ID No 3 ⁷			
I/No	Parameters	Contract Provision	Observation
		allocation ☞ Labor allocation ☞ Cash flow	<input checked="" type="checkbox"/> S-curve <input checked="" type="checkbox"/> Time space diagram <input checked="" type="checkbox"/> Manpower schedule <input checked="" type="checkbox"/> Machinery schedule <input checked="" type="checkbox"/> Material delivery <input checked="" type="checkbox"/> Organization structure
6	Revision	Revision required at quarterly interval	Revised three times, after 12, 24 & 5 month interval after the approval of the Engineer
7	Failure to mobilize in accordance with the program	Default of the contractor	No action was taken by the Engineer and Employer.
8	Milestones	☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery	Major milestones requested in the Contract are shown.
9	Monitoring	N/A	The program submitted has been used to monitor time target and cost target. However, as time pass by the revised program was not made and submitted by the contractor. As a result the monitoring done was not effective.
10	Practicality and implementation	N/A	It was observed that the program lacks mainly definition of critical path, lack of updating and the use of appropriate technique, hence, it can be said that the program is partially practical, as it does not satisfy the entire Murray's list.
11	Delay Analysis	☞ Not specified	The program is not usable for delay analysis, as the program does not have critical path and the logic is not defined as required. The time extension granted to the contractor was administratively granted

Case Study: Project ID No 3⁷			
I/No	Parameters	Contract Provision	Observation
			EOT. Though the program was done separately arguing that the floats are all consumed by the contractor, the second extension of time was requested using work program. Hence, it can be said that it has been partially used.

Table 32: [Case Study Project ID No 4]

Case Study: Project ID No 4 ⁸			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	☞ Project logic	<input checked="" type="checkbox"/> Contractual provisions, Choice of program method, WBS, establishment of project calendars, design of project logic, identification of critical path, climatic conditions, milestones, right of way requirement, external factors are not considered. <input checked="" type="checkbox"/> Activities are in the bottom level of WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available
2	Submission time	Within 28 days of receipt of the notice of acceptance	Submitted within 49 days from the letter of acceptance, which is 21 days delayed.
3	Contractual remedies for failure to submit	Not specified	No action taken.
4	Acceptance /Approval	Not specified	The program was reviewed and commented by the Engineer. However, to date no approval was given by the Engineer. Review of the records show that some of the comments forwarded are to consider the factors listed in (1) above.
5	Methods /Techniques	☞ Method statement ☞ In addition, the following detail is listed Arrangement, Timing and order	<input checked="" type="checkbox"/> Bar chart <input checked="" type="checkbox"/> Work load <input checked="" type="checkbox"/> Cash flow (partial)
6	Revision	Not specified	Though the program was not accepted by the Engineer, the Contractor after four month has submitted revised schedule.
7	Failure to	Not specified	No action was taken by the Engineer and

⁸ Project data if the project is attached as annex.

Case Study: Project ID No 4⁸			
I/No	Parameters	Contract Provision	Observation
	mobilize in accordance with the program		Employer.
8	Milestones	Not Specified	Review of the Gantt chart submitted showed the following milestones; <input checked="" type="checkbox"/> Contractor's establishment <input checked="" type="checkbox"/> Start and finish dates
9	Monitoring	N/A	The program submitted has been used to monitor time target and cost target. However, due to the contractor's failure to submit revised baseline program the Engineer faced difficulty in the monitoring of progress.
10	Practicality and implementation	N/A	It was observed that the program lacks, project logic creation, definition of critical path, lack of updating and the use of appropriate technique, Hence, it can be said that the program is not practical, as it does not satisfy the Murray's list.
11	Delay Analysis	☞ Not specified	The program is not usable for delay analysis, as the program lacks the basic assumptions. Review of records showed that the granted extension of time has not been made with delay analysis using work program. Likewise, the consultant has not also used the program for delay analysis.

Table 33: [Case Study Project ID No 5]

Case Study: Project ID No 5 ⁹			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	☞ Project logic	<input checked="" type="checkbox"/> Choice of program method, WBS, establishment of project calendars, identification of critical path, climatic conditions, right of way requirement, external factors are not considered. <input checked="" type="checkbox"/> Activities are in the bottom level of WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available
2	Submission time	Within 28 days of receipt of the notice of acceptance	No data available
3	Contractual remedies for failure to submit	Not specified	No action taken.
4	Acceptance /Approval	Not specified	The program was reviewed and commented by the Engineer. However, to date no approval was given by the Engineer.
5	Methods /Techniques	☞ Method statement ☞ In addition, the following detail is listed Arrangement, Timing and order	<input checked="" type="checkbox"/> Bar chart <input checked="" type="checkbox"/> Work load
6	Revision	Not specified	No revised work program submitted.
7	Failure to mobilize in accordance with the program	Not specified	No action was taken by the Engineer and Employer.

⁹ Project data if the project is attached as annex.

Case Study: Project ID No 5⁹			
I/No	Parameters	Contract Provision	Observation
8	Milestones	Not Specified	<p>Review of the Gantt chart submitted showed the following milestones;</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Commencement date <input checked="" type="checkbox"/> Site handover <input checked="" type="checkbox"/> Machinery mobilization <input checked="" type="checkbox"/> Laboratory facilities <input checked="" type="checkbox"/> End of asphalt surfacing work and the project
9	Monitoring	N/A	The program submitted has been used to monitor time target. However, due to the contractor's failure to submit corrected baseline program, the Engineer has faced difficult in monitoring of the work.
10	Practicality and implementation	N/A	It was observed that the program lacks, project logic creation, lack of updating and the use of appropriate technique, Hence, it can be said that the program is partially practical, as it does not fully satisfy the Murray's list.
11	Delay Analysis	☞ Not specified	<p>The program is not usable for delay analysis, as the program does not have clear critical path and the logic is not defined as required.</p> <p>In relation, neither the Contractor nor the Engineer has used the program for delay analysis.</p>

Table 34: [Case Study Project ID No 6]

Case Study: Project ID No 6 ¹⁰			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years. 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Choice of program method, right of way requirement, project logic, external factors are missing. <input checked="" type="checkbox"/> Activities are shown in the bottom level of the WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available.
2	Submission time	Within 42 days of receipt of the letter of acceptance	Submitted within 241 days from the letter of acceptance, which is 199 days delayed.
3	Contractual remedies for failure to submit	With held 50,000 birr per week of a delay	No action taken by the Engineer.
4	Acceptance /Approval	Not specified	<p>The program was reviewed and commented by the Engineer. To date the contractor has not submitted corrected base line program to the Engineer.</p> <p>Having reviewed the Engineer's comments, it is learnt that some of the comments are not in accordance to the contract.</p> <p>In addition, it is also learnt that the there is disagreement with assumptions the Engineer and the contractor.</p>
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment allocation ☞ Labor allocation ☞ Cash flow 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Method statement <input checked="" type="checkbox"/> Gantt chart <input checked="" type="checkbox"/> Work load <input checked="" type="checkbox"/> Cash flow <input checked="" type="checkbox"/> S-curve <input checked="" type="checkbox"/> Time space diagram <input checked="" type="checkbox"/> Manpower schedule <input checked="" type="checkbox"/> Machinery schedule <input checked="" type="checkbox"/> Material delivery

¹⁰ Project data if the project is attached as annex.

Case Study: Project ID No 6¹⁰			
I/No	Parameters	Contract Provision	Observation
6	Revision	Revision required at quarterly interval	No revision was made, as the original program has not been corrected and submitted to the Engineer.
7	Failure to mobilize in accordance with the program	Default of the contractor	No action was taken by the Engineer and Employer.
8	Milestones	<ul style="list-style-type: none"> ☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery ☞ Possession of site 	<p>The following milestones are shown in the program;</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Commencement date <input checked="" type="checkbox"/> Completion date <input checked="" type="checkbox"/> Contractor's site establishment and mobilization. <input checked="" type="checkbox"/> Provision of Engineer's facilities
9	Monitoring	N/A	<p>The program submitted is being in use by the Engineer for monitoring of time and cost.</p> <p>A further look at of the program against the progress of this project reveals that the schedule is already behind schedule.</p>
10	Practicality and implementation	N/A	<p>It was observed that the program lacks project logic creation (partially). Hence, it can be said that the program is practical and implementable as most of the variables in Murray's list are satisfied.</p>
11	Delay Analysis	Not specified	<p>The program is not usable for delay analysis, as the program does not have correct project logic and clear critical path. No time extension was submitted by the contractor.</p>

Table 35: [Case Study Project ID No 7]

Case Study: Project ID No 7 ¹¹			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years. 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Choice of program method, external factors are missing. <input checked="" type="checkbox"/> Activities are shown in the bottom level of the WBS. <input checked="" type="checkbox"/> The remaining parameters that can be observed from the program are available.
2	Submission time	Within 42 days of receipt of the letter of acceptance	Submitted within 148 days from the letter of acceptance, which is 106 days delayed.
3	Contractual remedies for failure to submit	Not specified	No action taken by the Engineer.
4	Acceptance /Approval	Not specified	<p>The program was reviewed and commented by the Engineer. Once again the Engineer commented on the program. The contractor once again corrected some points and submitted again. Finally, the Engineer has forwarded his acceptance with reservations on the contractor's project calendar computation and productivity outputs assumed by the contractor after 319 cal days from the letter of acceptance.</p> <p>Having reviewed the Engineer's the comments forwarded by the Engineer, it is noted that;</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Some of the comments are not in accordance to the contract. <input checked="" type="checkbox"/> Disagreement with assumptions the Engineer and the contractor. <p>The contract signature was delayed and the contractor tends to wait the signature of the contractor to submit.</p>

¹¹ Project data if the project is attached as annex.

Case Study: Project ID No 7 ^{II}			
I/No	Parameters	Contract Provision	Observation
			In addition, from the comments and responses of the contractor, it is noted that the Contractor does not have work programming expert.
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment allocation ☞ Labor allocation ☞ Cash flow 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Method statement <input checked="" type="checkbox"/> Gantt chart <input checked="" type="checkbox"/> Work load <input checked="" type="checkbox"/> Cash flow <input checked="" type="checkbox"/> S-curve <input checked="" type="checkbox"/> Time space diagram <input checked="" type="checkbox"/> Manpower schedule <input checked="" type="checkbox"/> Machinery schedule <input checked="" type="checkbox"/> Material delivery <input checked="" type="checkbox"/> Organization structure
6	Revision	Revision required at quarterly interval	No revision was made by the contractor.
7	Failure to mobilize in accordance with the program	Default of the contractor	No action was taken by the Engineer and Employer.
8	Milestones	<ul style="list-style-type: none"> ☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery ☞ Possession of site 	<p>The following milestones are shown in the program;</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Commencement date <input checked="" type="checkbox"/> Completion date <input checked="" type="checkbox"/> Contractor's site establishment and mobilization. <input checked="" type="checkbox"/> Provision of Engineer's facilities <input checked="" type="checkbox"/> Right of way requirement <input checked="" type="checkbox"/> Office engineering work <input checked="" type="checkbox"/> Surveying work <input checked="" type="checkbox"/> Sectional handover dates
9	Monitoring	N/A	<p>The program submitted is being in use by the Engineer for monitoring of time and cost.</p> <p>A further look at of the program against the progress of this project reveals that the schedule is already behind schedule and no</p>

Case Study: Project ID No 7¹¹			
I/No	Parameters	Contract Provision	Observation
			updates was submitted by the contractor.
10	Practicality and implementation	N/A	It was observed that the program have the basic parameters in Murray's list. Hence, it can be said that the program is practical and implementable.
11	Delay Analysis	☞ Not specified	The program submitted has stand alone program showing the critical path, which is usable for delay analysis. However, no time extension was submitted by the contractor using work program. However, the Engineer in his assessment for the contractor's EOT No 1 in association with adverse weather condition, used the contractor's base line program for delay analysis.

Table 36: [Case Study Project ID No 8]

Case Study: Project ID No 8 ¹²			
I/No	Parameters	Contract Provision	Observation
1	Factors considered	<ul style="list-style-type: none"> ☞ Climatic, groundwater and other conditions ☞ Productivity ☞ 15 holidays per calendar years. 	<ul style="list-style-type: none"> ☑ WBS have not been considered, all activities in the BOQ are listed in the program. Hence, activities are shown in the bottom level of the WBS. ☑ Choice of program method, external factors are missing. ☑ The remaining parameters that can be observed from the program are available.
2	Submission time	Within 42 days of receipt of the letter of acceptance	Within 189 days from the letter of acceptance, this is 147 days delayed.
3	Contractual remedies for failure to submit	Not specified	No action taken by the Engineer.
4	Acceptance /Approval	Not specified	<p>The program was reviewed and commented by the Consultant. The contractor resubmitted the program for further review and the Consultant again commented on some points. Finally, the program was accepted on March 17th, 2014.</p> <p>Generally, the many pages comments of the engineer showed that the program lacks the basic assumptions and considerations. In addition, there are also comments given by the Consultant that are not in accordance with the Contract.</p>
5	Methods /Techniques	<ul style="list-style-type: none"> ☞ CPM Network ☞ Method statement ☞ Gantt Chart ☞ Equipment allocation ☞ Labor allocation 	<ul style="list-style-type: none"> ☑ Method statement ☑ Gantt chart ☑ Cash flow ☑ Manpower schedule ☑ Machinery schedule ☑ Material delivery

¹² Project data if the project is attached as annex.

Case Study: Project ID No 8 ¹²			
I/No	Parameters	Contract Provision	Observation
		☞ Cash flow	
6	Revision	Revision required at quarterly interval	No revision was made so far; however, the project is already delayed.
7	Failure to mobilize in accordance with the program	Default of the contractor	No action was taken by the Engineer and Employer.
8	Milestones	☞ Mobilization ☞ Engineers site facilities ☞ Contractors site facilities ☞ Equipment delivery ☞ Manpower delivery ☞ Possession of site	The following milestones are shown in the program; <input checked="" type="checkbox"/> Commencement date <input checked="" type="checkbox"/> Completion date <input checked="" type="checkbox"/> Contractor's site establishment and mobilization. <input checked="" type="checkbox"/> Provision of Engineer's facilities
9	Monitoring	N/A	The program submitted is being in use by the Engineer for monitoring of time and cost. However, due to the recorded delay and slippage in the program the monitoring work is not effective.
10	Practicality and implementation	N/A	The program lacks the basic parameters listed, including the identification of critical path, use of appropriate tool and hence, it is not practical.
11	Delay Analysis	☞ Not specified	With the limitation stated above, it is difficult to use the program for delay analysis purpose.

4.2.1. Summary of Observation from Case Study Projects

Summary of observation obtained from case study projects is presented here in below in each category;

(a) Factors of Work Programming and Implementation

Case study on selected eight projects revealed that work programs evaluated lacks the factors identified in the literature survey;

- ↪ Choice of work programming method
- ↪ Right of way requirement description
- ↪ Design of project logic
- ↪ External factors
- ↪ Project calendar establishment
- ↪ Definition of milestones
- ↪ Climatic conditions

(b) Submission and Approval

Result of the case study revealed the following core points;

- ↪ Most of the programming methods are in use except critical path method and time space diagram.
- ↪ All of the programs considered for case study have failed to be submitted and get approval by the time specified in the contract. The failure is associated with; in adequate program prepared by contractors, disagreement with assumptions, engineer's unlimited comments; comments were not in accordance with the provision of the contract.
- ↪ Contractual remedies are set but no action is taken in most of the projects. Further, the remedies set out also found to be insufficient.

(c) Progress Monitoring

Results obtained from the case study showed that;

- ↪ The programs submitted are used to monitor time targets of the project.
- ↪ Due to the absence of final and updated program difficulties are encountered.
- ↪ Revisions of programs are not being carried out in accordance with the requirement set out in the contract.

(d) Milestones

Results of the case study showed that milestones are usually shown on the programs evaluated.

(e) Practicality of Programs

Results of the case study revealed that the programs submitted by contractors are usually practical and implementable.

(f) Review of Remedial Rights/Delay Analysis

Results of the case study showed that contractors as well as the Engineer do not use work programs for the delay analysis in the projects.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are forwarded based on the information contained in this research work.

5.1. Conclusions

In the previous chapter, the results attained in the analysis of the questionnaire survey and case study is discussed, and based on the findings from the same, the following major conclusions have been made:

1. The research showed that the factors identified in the pre-programming, programming and post programming stages are being considered during the preparation and implementation of work programs. However, the study also revealed that limitations are observed in relation to choice of work programming method, right of way requirement description, design of project logic, external environment factors, project calendar establishment, and climatic conditions.
2. The study revealed that there is delay in the submission and approval of work programs exist in federal road project and the delay is mainly associated with absence of programming expert in each party, disagreement with the assumptions and considerations and consultants and client's unlimited demand or request.

In addition, the following factors are identified to contribute for the delay recorded in submission and approval;

- ☞ No attention is given to its preparation and timely submission
 - ☞ Lack of commitment from the contractor and from the consultant to act on time
 - ☞ Contractors submit program that they do not implement
 - ☞ Absence of sufficient and enforceable contractual remedies in the contract.
 - ☞ The time specified in the FIDIC 1987 and PPA 2006 are not enough
3. Work programs submitted and updated by the contractors are identified to have low contribution to progress monitoring and make corrective measures. This is due to the fact that;
 - ☞ Work programs are not revised and submitted to communicate the actual status of the project as per the time specified in the contract or as required by the progress of the project.
 - ☞ Though contractor's use monthly reporting systems within the organization, it is

noted that it is not being used for monitoring of progress and taking corrective actions of updating programs.

- ☞ The programs submitted are not realistic or already delayed.
4. The study also revealed that work programs submitted and updated by contractors are practical and implementable. However, deficiencies in the work programs are observed, which may associate to;
- ☞ The resources cited on the program are not mobilized on site.
 - ☞ The programs submitted by contractors have already delayed before it is implemented.
 - ☞ Change of program by the contractor.
5. The study revealed that work programs submitted by contractors do not usually assist in tracking of deliverables and milestones. The following factors are identified to contribute to the failure of programs for tracking of deliverables;
- ☞ Failure to update work programs
 - ☞ Failure to define project deliverables
 - ☞ Failure of the contract to show defined project deliverables.
6. The study revealed that work programs submitted by contractors do not assist for review of remedial rights or delay analysis and evaluation of claims. The factors that are attributable for this are;
- ☞ Failure to use appropriate method of programming
 - ☞ Failure to use realistic work breakdown structures
 - ☞ Failure to use realistic project link

5.2. Recommendations

Following the detail study of the work programming and implementation practice in federal road project, analysis of the collected data on the same and conclusions made, the under listed recommendations are deducted. For the sake of presentation the recommendations are presented in three groups.

1. Contractor

- ☞ Assignment of proper professional for the work planning and programming preparation.

- ☞ Provide periodic training to project management team in relation to work programming and implementation.
- ☞ Conduct continuous monitoring to get information and feedback for project updates.
- ☞ Understand the contractual implications of the non compliance
- ☞ Comply with the work program submitted or submit work program that the contractor can comply on.

2. Client

- ☞ Define and include realistic program requirement or specifications in the contract for the preparation and implementation of work programs
- ☞ Put realistic time in the contract documents for submission and approval of work programs and include strong and enforceable contractual remedies for non compliance
- ☞ Allocate practical project durations in the contract and how commitment to the contractor's program

3. Consultant

- ☞ Forward comments, approval and withdrawal of approval within reasonable time
- ☞ Avoid the provision of unrealistic comments.
- ☞ Closely monitor the progress of the project and take the contractual measures

5.3. Recommendation for Future Research

The researcher would like to suggest for future research that are related with this study are:

- ☞ Study on work programming methods that are best for road construction projects.
- ☞ Establish productivity rates of equipment used in the Ethiopian construction sector under the prevailing conditions of projects located at the four corners of the country. The output of such studies could be used in the planning of resources.
- ☞ Comparison of work programs made by foreign and domestic contractors. The output of such study will assist the domestic contractor to share lessons.
- ☞ Study on how to improve the cash flow of contractors and finance projects to achieve project goals. The output of such study will assist contractors to understand the key factors and learn to allocate sufficient budget for the implementation.

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APPENDICES

Appendix-1: Research Questionnaire

1. General Background Information

The questions below are related to your organisation and yourself. Please indicate your response by ticking (X or √) the appropriate box (es) or by filling the blank spaces provided, as appropriate.

1.1 Name of organization (Optional): _____

1.2 To which one of the parties is your organization categorized:

Employer

Contractor

Consultant

1.3 Origin of your company:

Local

Foreign

1.4 Years since establishment:

More than 10 years

5-10 years

Less than 5 years

1.5 The organization's experience in road construction projects in Federal road projects

More than 10 years

5-10 years

Less than 5 years

1.6 Your experience on road projects:

More than 10 years

5-10 years

Less than 5 years

1.7 Do you have experience in projects using FIDIC 1987/1992 (Red book) as the Conditions of the Contract?

Yes

No

1.8 Do you have experience in projects using PPA 2006 as conditions of Contract?

Yes

No

1.9 Your Name, Title and Contact address:

☞ Name (optional): _____

☞ Job Title: _____

☞ Tel (optional): _____

☞ E-mail address: _____

2. Ranking the Factors that are Considered in Work Program Development

The following factors required to be considered for the preparation of work programs are identified from review of literature and personal experience in the process of contract administration in road construction projects.

Please consider in terms of your organization's experience and/or your knowledge the degree of consideration of the following factors in the work program preparation practice and respond by ticking in (X or ✓) the appropriate box or filling the blank space provided, as appropriate. For other factors which require specific elaborations, please reply to the subjective questions in the space provided.

2.1. Factor in pre-programming stage

I/No	Description	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Project nature, size and complexity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Manpower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Equipment and Plants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Budget/Funds	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Optimum Project Update Cycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Work Programming Expert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Upper Management Support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Contract provision for submission and approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	<i>Please specify if any other factor</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.2. Factors in Programming stage

I/No	Description	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Choice of Programming Method/Technique(s)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Work Breakdown Structure (WBS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I/No	Description	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3	Identify the Project and Schedule	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Establish Project Calendars and Work Periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Define project Milestones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Design the Project's Logic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Determining the Duration for Each Activity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Identifying the Critical Path	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Program Risk Analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Coordination with other team members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Right of way requirement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	climatic conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	external environment factors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<i>Please specify if any other factor</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

i. If you 'Agree' or 'Strongly Agree' in Q 2.2(2), what is the least level in the work breakdown structure hierarchy?

Project Work Package Activities Operations

ii. If you 'Agree' or 'Strongly Agree' in Q 2.2(4), which one of the following factors are considered?

Holidays Sundays Non working days declared by the firm
 Rainy season Rainy days in the dry season

2.3. Factors in the post programing stage

I/No	Description	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	User Resistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Schedule user training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I/No	Description	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3	Conflicts among team members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Commitment of all parties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Continuous top management involvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<i>Please specify if any other factor</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Submission and Approval

The following questions are related to the practices of submission and approval in federal road construction projects. From your organizations experience and/or your knowledge; Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

3.1. Which of the following techniques of work program(s) are used and submitted by Contractors? (You may choose any number of the methods).

- Method Statement Gantt Chart/Time Bar Chart Network Diagram in CPM
 Time Space Diagram Cash Flow S-Curve
 Organization Structure Machinery Requirement and Delivery Schedule
 Manpower Requirement and Mobilization Schedule
 Material Requirement and Delivery Schedule

Please mention if any other _____

3.2. The requirements (methods and specific requisite) of the contracts concerning work program are sufficient and exhaustive?

- Strongly agree Agree Neutral Disagree Strongly Disagree

3.3. The time specified in the Conditions of contract (FIDIC 1987 and PPA 2006) for the submission of work program is sufficient?

Strongly agree Agree Neutral Disagree Strongly Disagree

3.4. If you 'Disagree' or 'Strongly disagree' in Q 3.3, please mention your comments.

3.5. Contractors submit and get approval/acceptance for their Work Programmes within the period specified in the Contract.

Strongly agree Agree Neutral Disagree Strongly Disagree

3.6. If you 'Disagree' or 'Strongly disagree' in Q 3.5, what do you think the possible reasons? (You may chose more than one).

- The requirement stated in the contract is higher
- Consultants and Employer's comments and unlimited demand
- The time specified in the contract is not adequate
- Disagreement with the assumptions and considerations
- Absence of programming expert in each parties
- If any other, please specify,

3.7. Contractual remedies are set in the conditions of Contracts for the failure to submit work programmes within the specified period are sufficient and enforceable.

Strongly agree Agree Neutral Disagree Strongly Disagree

3.8. If you 'Disagree' or 'Strongly disagree' in Q 3.7, please mention your comments.

3.9. Do the contracts you are involved have program specification/requirement in the contract?

Strongly agree Agree Neutral Disagree Strongly Disagree

3.10. If you 'Agree' or 'Strongly Agree' in Q 3.9, which one of the following factor are included? (You may choose more than one).

I/No	Specification or Requirement	Requirement
1	The program method/techniques to be used;	<input type="checkbox"/>
2	The level of program detail required by the contract	<input type="checkbox"/>

I/No	Specification or Requirement	Requirement
3	The need to incorporate all contractually specified milestones. (provision of facilities, deliveries of equipment, dates for access to the project, right of way requirement)	<input type="checkbox"/>
4	Procedures for shop drawings (preparation, submission, and approval);	<input type="checkbox"/>
5	Procedures for submittals (initial and updates, plus frequency);	<input type="checkbox"/>
6	Procedures for review and approval of the schedule;	<input type="checkbox"/>
7	Remedies for noncompliance;	<input type="checkbox"/>
8	Updating procedures (specifying frequency);	<input type="checkbox"/>
9	Whether or not the schedule will be used for determining progress payments;	<input type="checkbox"/>
10	Procedures for justification of time extensions (using time impact analysis);	<input type="checkbox"/>
11	Float utilization and availability to project and parties; and	<input type="checkbox"/>
12	If any other, please specify	<input type="checkbox"/>

4. Monitoring of progress

The following questions are related to the practices of monitoring of progress in federal road construction projects. From your organizations experience and/or your knowledge;

Please indicate the extent of you agreement or disagreement by putting (x or ✓) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

4.1. The programs submitted by contractors will assist to monitor the progress of projects and identify the areas where corrective action is required to be taken in order to ensure proper implementation:

Strongly agree Agree Neutral Disagree Strongly Disagree

4.2. If you 'Disagree' or 'Strongly disagree' in Q 4.1, which one of the following factors describe the factor you encountered;

- The programs are not realistic

- The programs are not updated as required.
- If any other, please specify _____

4.3. If you 'Agree' or 'Strongly Agree' in Q 4.1, which one of the following targets of the program are monitored.

- Time progress
- Cost progress
- Resource productivity
- Manpower productivity
- Material Consumption

4.4. Contractors use reporting system that compares program versus executed for the efficiency and effectiveness of project monitoring.

Strongly agree Agree Neutral Disagree Strongly Disagree

4.5. If you 'Agree' or 'Strongly Agree' in Q 4.4, which one of the following reporting frequency of project monitoring strategy implemented.

Daily Weekly Bi-monthly Monthly

4.6. If you 'Disagree' or 'Strongly disagree' in Q 4.4, write your comments the system being used;

4.7. Work Programmes are revised and submitted to communicate actual status of the project.

Strongly agree Agree Neutral Disagree Strongly Disagree

4.8. Work Programmes are revised and submitted as per the time specified or as required by the progress of the project.

Strongly agree Agree Neutral Disagree Strongly Disagree

5. Constructability/implementation of work programs

The following questions are related to the practicality in the implementation of work program in federal road construction projects. From your organizations experience and/or your knowledge;

Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

5.1. The work programs submitted by contractors are used as implementation guidance.

Strongly agree Agree Neutral Disagree Strongly Disagree

5.2. If you 'Disagree' or 'Strongly disagree' in Q 5.1, which one of the following factors contribute describe your views.

- ☞ The programs submitted are not practical and implementable
- ☞ The programs submitted already delayed
- ☞ The information depicted on the program does not show the actual situation
- ☞ Change of program by the contractor
- ☞ The resources cited on the program are not mobilized on site
- ☞ IF any other, please specify _____

5.3. The followings are the factors that are required to measure the practicality of the program. Please select the factors that you believe represent your views.

- The activities or the tasks are adequately defined through the work breakdown structure.
- Appropriate technique or method is used for the programming
- Activities or tasks are appropriately sequenced so that which has to be done before and which has to be done later has to be clearly defined.
- Assignment of proper number of construction resources, mainly equipments.
- Program updates are not carried out as required
- If any other, please specify, _____

6. Tracking of deliverables and Millstones

The following questions are related to the tracking Deliverables or milestones set out in the work programs in federal road construction projects. From your organizations experience and/or your knowledge;

Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

6.1. Work programs submitted by the contractors define project deliverables and milestones to the required level by the contract.

Strongly agree Agree Neutral Disagree Strongly Disagree

6.2. Contractors usually achieve the milestones and deliverables set out in the work programs.

Strongly agree Agree Neutral Disagree Strongly Disagree

6.3. If you 'Disagree' or 'Strongly disagree' in Q 6.2, please forward your comment your reasons;

6.4. Which one of the following milestones are used/encountered in your projects.

- Start of the project
- Finish of the project
- Delivery of Engineer's facilities
- Possession of site requirements
- Surveying work
- Office engineering works
- Work package completion
- Activities completion
- Sectional completion

6.5. Work program submitted by the contractor usually used in the tracking of deliverables.

Strongly agree Agree Neutral Disagree Strongly Disagree

6.6. If you 'Disagree' or 'Strongly disagree' in Q 6.5, to which one of the following problems is the reasons related;

- Failure to define project deliverables
- Failure to update the program
- The contract documents does not clearly define project deliverables
- No intention by the contractor to describe such commitment dates

7. Review of Remedial Rights

The following questions are related to the review of remedial rights using work programs in federal road construction projects. From your organizations experience and/or your knowledge;

Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

7.1. Which method/techniques of preparing work program do you use to prepare/analyse delay claims?

Method Statement Gantt Chart/Time Bar Chart Network Diagram in CPM

Time Space Diagram Cash Flow S-Curve

Organization Structure Machinery requirement and Delivery Schedule

Manpower requirement and Mobilization Schedule

Material Requirement and Delivery Schedule

Please mention if any other _____

7.2. Researches show that Impacted as planned method is the most frequently used delay analysis method in Ethiopian Federal road projects. The work programs prepared by the contractor assist for delay analysis techniques.

Strongly agree Agree Neutral Disagree Strongly Disagree

7.3. If you ‘Disagree’ or ‘Strongly disagree’ in Q 7.2, to which one of the following factors will the reason fall;

- Failure to use appropriate method
- Failure to identify input factors
- Failure to use realistic project link
- Failure to identify project milestones
- Failure to use realistic work breakdown structures
- The programs does not clearly show critical activities and critical path
- The programs submitted are not realistic
- If any other please specify. _____

8. General Questions

The following questions are general in work programming and implementation of work programs in federal road construction projects. From your organizations experience and/or your knowledge; Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

8.1. Contractors give sufficient emphasis for work programming.

Strongly agree Agree Neutral Disagree Strongly Disagree

8.2. Some professionals states that “Contractors present work programmes for the sake of contractual requirements.” What is your view on this conclusion with respect practice?

Strongly agree Agree Neutral Disagree Strongly Disagree

8.3. Professionals states that work programming practice by foreign contractors is by far better quality than the domestic contractors. What is your view on this conclusion with respect practice?

Strongly agree Agree Neutral Disagree Strongly Disagree

8.4. Projects with properly done work programs have a better progress than those with no programs or defective programs.

Strongly agree Agree Neutral Disagree Strongly Disagree

8.5. Work program submitted by the contractor is considered as part of contract document or it will take a status of contract.

Strongly agree Agree Neutral Disagree Strongly Disagree

9. Improvement action/suggestions questions

The following questions are aimed to be benefited from your experience for the improvements or intervention actions to be taken for work programming practice in federal road construction projects. From your organizations experience and/or your knowledge;

Please indicate the extent of you agreement or disagreement by putting (x or √) mark in the appropriate box. Please also provide your views on the space provided for the issues that request your additional information.

9.1. The following factors are factors identified for improvement actions in the preparation of work programs

I/No	Improvement Factor	Yes	No
A. General			
1	Improve the contract management practice of		
	- Contractor	<input type="checkbox"/>	<input type="checkbox"/>
	- Consultant	<input type="checkbox"/>	<input type="checkbox"/>
	- Employer	<input type="checkbox"/>	<input type="checkbox"/>
B. Contractor's Related			
2	Assignment of proper professional for the planning and programming	<input type="checkbox"/>	<input type="checkbox"/>
3	Provision of training to project management team	<input type="checkbox"/>	<input type="checkbox"/>
4	Project planners should communicate all project participants	<input type="checkbox"/>	<input type="checkbox"/>
	Continuous and proper planning before construction, so that resources and time are sufficient	<input type="checkbox"/>	<input type="checkbox"/>
5	Conduct continuous monitoring to get information and feedback for project updates	<input type="checkbox"/>	<input type="checkbox"/>

I/No	Improvement Factor	Yes	No
A. General			
6	Contractors should manage their financial resources and plan cash flow	<input type="checkbox"/>	<input type="checkbox"/>
7	Implementation of Management information system	<input type="checkbox"/>	<input type="checkbox"/>
8	Assign sufficient number and type of resources	<input type="checkbox"/>	<input type="checkbox"/>
9	Understand the contractual implications of the non compliance	<input type="checkbox"/>	<input type="checkbox"/>
C. Employer's Related			
1	Include realistic requirement for the preparation of work programs	<input type="checkbox"/>	<input type="checkbox"/>
2	Define project program requirement and specification and include in the contract	<input type="checkbox"/>	<input type="checkbox"/>
3	Put realistic submission and approval date in the conditions of contract	<input type="checkbox"/>	<input type="checkbox"/>
4	Show commitment to the contractor's program	<input type="checkbox"/>	<input type="checkbox"/>
5	Allocate practicable project durations	<input type="checkbox"/>	<input type="checkbox"/>
6	Include strong and enforceable contractual remedies for non compliance	<input type="checkbox"/>	<input type="checkbox"/>
7	Develop applicable productivity/output standards	<input type="checkbox"/>	<input type="checkbox"/>
D. Consultant's Related			
1	Forward comments, approval and withdrawal of approval within reasonable time	<input type="checkbox"/>	<input type="checkbox"/>
2	Avoid unrealistic comments	<input type="checkbox"/>	<input type="checkbox"/>
3	Improve the capacities of project team in work programming	<input type="checkbox"/>	<input type="checkbox"/>
4	closely monitor the progress of the project and take the contractual measures	<input type="checkbox"/>	<input type="checkbox"/>

9.2. What do you suggest as measure to improve the preparation and implementation of work programs?

a. Contractor's related

b. Consultant's related

c. Employer's related

d. Conditions of Contract Clauses modification, addition and/or deduction from FIDIC 87 and PPA 2006

9.3. Other comments you may forward with regard to the subject matter

----- The End -----

Please kindly check that no points are escaped and Thank You For Your Time!!!

Appendix-2: Basic data of Case Study Projects

Project Name	Project ID No 1	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Domestic	
Length (km)	36km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>FIDIC Based</i>	
Construction Type	Gravel road, new construction	
Notification of Award	October 29, 2012	
Contract Signing Date	November 01, 2012	
Commencement Date	November 22, 2012	
Original Completion Date	November 22, 2014	
Original Contract Period	730 calendar days (or 24 months)	
Maintenance Period	365 days from the date of issue of Taking Over certificate	
EOT Approved (days)	231 cal days	
Progress	76%	
Revised Completion Date	July 11, 2015	
Actual Completion Date	On progress	
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 195,166,216.15
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name		Project ID No 2	
Funding	Federal Democratic Republic of Ethiopia		
Contracting Authority	Ethiopian Roads Authority		
Contractor's Origin	Domestic		
Length (km)	22.83km		
Type of Contract	<i>Re measurement</i>		
Conditions of Contract	<i>FIDIC Based</i>		
Construction Type	DBST, road upgrading project		
Notification of Award	October 29, 2012		
Contract Signing Date	November 01, 2012		
Commencement Date	November 30, 2012		
Original Completion Date	November 29, 2014		
Original Contract Period	730 calendar days (or 24 months)		
Maintenance Period	365 days from the date of issue of Taking Over certificate		
EOT Approved (days)	347		
Progress	86%		
Revised Completion Date	November 11 ,2015		
Actual Completion Date	On progress		
Financial Data	Foreign Currency	Local Currency	
Contract Amount	Nil	ETB 516,442,158.68	
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.	
Advance Payments	Nil	20 % of the contract sum, including VAT.	

Project Name	Project ID No 3	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Domestic	
Length (km)	58.7km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>FIDIC Based</i>	
Construction Type	DBST, new road project	
Notification of Award		
Contract Signing Date	September 15, 2009	
Commencement Date	October 15, 2009	
Original Completion Date	April 15, 2012	
Original Contract Period	913 calendar days (or 24 months)	
Maintenance Period	365 days from the date of issue of Taking Over certificate	
EOT Approved (days)	419	
Progress	100%, Completed	
Revised Completion Date		
Actual Completion Date	Completed	
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 444,845,504.10
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name	Project ID No 4	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Domestic	
Length (km)	2.8km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>PPA based</i>	
Construction Type	DBST, upgrading road project	
Notification of Award		
Contract Signing Date	September 12, 2014	
Commencement Date	September 27, 2014	
Original Completion Date	March 25, 2015	
Original Contract Period	182 calendar days	
Maintenance Period	365 days from the date of issue of Taking Over certificate	
EOT Approved (days)	94 cal days	
Progress	88%,	
Revised Completion Date		
Actual Completion Date		
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 82,342,122.90
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name	Project ID No 5	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Domestic	
Length (km)	3.5km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>PPA based</i>	
Construction Type	DBST, upgrading road project	
Notification of Award		
Contract Signing Date	August 12, 2011	
Commencement Date	September 12, 2011	
Original Completion Date	September 12, 2012	
Original Contract Period	365 calendar days	
Maintenance Period	365 days from the date of issue of Taking Over certificate	
EOT Approved (days)	266 cal days	
Progress	Terminated,	
Revised Completion Date		
Actual Completion Date		
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 79,185,451.40
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name	Project ID No 6	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Domestic	
Length (km)	101km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>FIDIC based</i>	
Construction Type	DBST, upgrading road project	
Notification of Award		
Contract Signing Date	October 29, 2014	
Commencement Date	November 18, 2014	
Original Completion Date	November 17, 2017	
Original Contract Period	1093 calendar days	
Maintenance Period	365 days from the date of issue of Taking Over certificate	
EOT Approved (days)	0 cal days	
Progress	18%,	
Revised Completion Date		
Actual Completion Date		
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 988,088,126.92
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name	Project ID No 7	
Funding	Federal Democratic Republic of Ethiopia	
Contracting Authority	Ethiopian Roads Authority	
Contractor's Origin	Foreign	
Length (km)	91.9km	
Type of Contract	<i>Re measurement</i>	
Conditions of Contract	<i>FIDIC based</i>	
Construction Type	Asphalt concrete, upgrading road project	
Notification of Award		
Contract Signing Date	September 09, 2013	
Commencement Date	October 11, 2013	
Original Completion Date	November 17, 2017	
Original Contract Period	1095 calendar days	
Maintenance Period	365 days from the date of issue of Taking Over certificate.	
EOT Approved (days)	0 cal days	
Progress	32%,	
Revised Completion Date		
Actual Completion Date		
Financial Data	Foreign Currency	Local Currency
Contract Amount	Nil	ETB 1,236,755,540.33
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.
Advance Payments	Nil	20 % of the contract sum, including VAT.

Project Name		Project ID No 8	
Funding	Federal Democratic Republic of Ethiopia		
Contracting Authority	Ethiopian Roads Authority		
Contractor's Origin	Foreign		
Length (km)	57.02km		
Type of Contract	<i>Re measurement</i>		
Conditions of Contract	<i>FIDIC 1987</i>		
Construction Type	Asphalt concrete, upgrading road project		
Notification of Award	December 20, 2012		
Contract Signing Date	January 23, 2013		
Commencement Date	April 1, 2013		
Original Completion Date	October 1, 2016		
Original Contract Period	1260 calendar days		
Maintenance Period	365 days from the date of issue of Taking Over certificate.		
EOT Approved (days)	101 cal days		
Progress	34%,		
Revised Completion Date			
Actual Completion Date			
Financial Data	Foreign Currency	Local Currency	
Contract Amount	Nil	ETB 834,554,046.54	
Liquidated Damages	Nil	0.1% of the Contract price per day less the value of the completed sections already handed over to the Employer.	
Advance Payments	Nil	20 % of the contract sum, including VAT.	